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Summary

The San Francisco Bay Hydrologic Region (Bay Region) occupies approximately 4,500 square miles; from southern Santa Clara County to Tomales Bay in Marin County; and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville. The region has many significant water management challenges- sustaining water supply, water quality, and the ecosystems in and around San Francisco Bay; reducing flood damages; and adapting to impacts from climate change. A thorough discussion of climate change is presented, including precipitation variability, reduced snowpack accumulation in the Sierra Nevada Mountains, and vulnerability of developed bay and coastal areas to sea level rise. However, with strong water planning and governance and several resource management strategies that can be applied, the region is poised to address these challenges effectively.

Resource Management Strategies and Policies

[Prioritize]

[Sources for this information may be IRWM plans, the Senate Bill x7-7 process, urban water management plans, agricultural water management plans, groundwater management plans, water elements of general plans, floodplain management plans, stormwater plans, Regional Water Quality Control Board basin plans and water quality reports, watershed management plans, habitat conservation plans, multi-species conservation plans, etc.]

[This section will directly support funding recommendations in the Update 2013 finance plan (Volume 1).]

Twenty-seven resource management strategies can be applied to help resolve water management challenges in the Bay Region. The strategies are grouped into six main categories- reduce water demand, improve operational efficiency and transfers, increase water supply, improve water quality, practice resource stewardship, and improve flood management. Some of the strategies are more applicable in the region than others. The Bay Area Integrated Regional Water Management (IRWM) Group (and others?) recommends implementation or expansion of the following resource management strategies:

- [X to improve water quality]
- [Y to improve flood management]
- [Z to improve groundwater recharge, etc.]

[GW Placeholder Text. Contains:

- Summary of groundwater-related resource management strategies and policies in the Hydrologic Region.
- Summary of groundwater data gaps for the Hydrologic Region, how these gaps affect groundwater management and policy, and recommendations to reduce data gaps in the future.
- Selected maps and tables from the main text of the report, as appropriate.

- Discussion on groundwater sustainability and sustainability indicators to monitor progress towards the resource sustainability.]

Finance

[This subsection contains a discussion of the following topics.

- An estimate of total funding proposals within the region.
- Public benefits of local and regional proposals (eligible for State funding).
- Cost-sharing criteria.]

[This section will directly support funding recommendations in the Update 2013 finance plan.

- Identify incentives, funding sources, and State actions to support regional strategies.]

[IFP Content:

- Summary of FM and IFM projects from the Flood Future Report for each region, including estimated costs.
- Summary of anticipated future Flood Management needs.]

The recommended resource management strategies need funding that is dedicated to develop IRWM projects throughout the Bay Region. Potential funding sources include designating funding areas, water and wastewater bond funding, and IRWM grant funding. Additional Federal stimulus funds are available through the American Recovery and Reinvestment Act. The region should maximize its share of the approximately $20 billion available to California.

Water Planning and Governance

[This subsection contains a discussion of the following topics.

- Institutional improvements, expansion of IRWM partnerships (e.g., tribal) and alternatives to IRWM when appropriate.]

[This section will take a critical look at IRWM as it pertains to each region.]

[IFP Content:

- Summary of Integrated Flood Planning governance structure from the Flood Future Report
- Table listing the integrated flood planning and governance within the HR.
- Discussions on integrated flood planning Case Studies from the Flood Future Report– successes and challenges.
- Coordination of proposed IFM planning areas with the IRWM regions.]

[GW Placeholder Text. Contains

- Summary of groundwater governance associated with the various groundwater management plans (GWMPs), Integrated Regional Water Management (IRWM) Plans, conjunctive management projects and groundwater recharge projects, groundwater monitoring, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.
- Summary table of groundwater-related planning and governance within the Hydrologic Region.
- Summary discussion on Case Studies – successes and challenges.]

Numerous government agencies and water districts deliver, treat, and regulate water in the Bay Region (see Table SFB-1). Many planning organizations identify present and future challenges in the region such as land use, housing, environmental quality, economic development, wetlands, water quality, water reliability, storm water management , flood protection, watershed management, groundwater management, fisheries, and ecosystem restoration (see Box SFB-1). An important planning organization in the Bay Region is the San Francisco Bay Area IRWM Group. The structure and function of this group is detailed in the Regional Water Management section. New activities that the government agencies, water districts, and planning organizations are doing in the region since *California Water Plan Update 2009* are discussed in the Implementation Activities (2009-2013) section.

Current State of the Region

[Note: Align with region description in IRWM Plan.]

Setting

[This subsection contains a discussion of the following topics.

- An overview of background factors that affect water availability, uses, quality, flood management, and ecosystems in the region and unique subregions.
- IRWM plans, basin plans, land use surveys, Department of Finance population data, conservancy reports, regional studies, climate programs, etc.
- Develop brief descriptions of tribal communities in the hydrologic region.
- Update background information about watershed topography, geology, rivers, and ecosystems.
- Update climate overview and identify trends.
- Update population and land use information and trends.
- Provide links to detailed information in the reference guide (Volume 4 of Update 2013).]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future]

The Bay Region includes all of San Francisco County and portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, Santa Cruz, and Alameda Counties. It occupies approximately 4,500 square miles; from southern Santa Clara County to Tomales Bay in Marin County; and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville (see Figure SFB-1). The eastern boundary follows the crest of the Coast Range; where the highest peaks are more than 4,000 feet above mean sea level. Water agencies in the region have relied on importing water from the Sierra Nevada for nearly a century to supply their customers. Water from the Mokelumne and Tuolumne Rivers accounts for about 38 percent of the region's average annual water supply. Water from the Delta via the Federal Central Valley Project (CVP) and the State Water Project (SWP) accounts for another 28 percent. Approximately 31 percent of the average annual water supply is from local groundwater and surface water, and 3 percent is from miscellaneous sources such as…. Population growth and concerns over diminishing water quality have led to the development of local surface water supplies, recharge of groundwater basins, and incorporation of conservation guidelines in a continuing effort to sustain water quality for future generations.

PLACEHOLDER Table SFB-1 Water Governance, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Box SFB-1 Planning Organizations, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Figure SFB-1 Map of the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The Sacramento and San Joaquin Rivers flow into the Sacramento-San Joaquin River Delta (the Delta) and into San Francisco Bay. The interaction between Delta outflow and Pacific Ocean tides determines how far salt water intrudes into the Delta. The resulting salinity distribution influences the distribution of many estuarine fish and invertebrates, as well as the distribution of plants, birds, and animals in wetlands areas. Delta outflow varies with precipitation, reservoir releases, and upstream diversions. An average of 18.4 million acre-feet of freshwater flows out of the Delta annually into the bay (California Data Exchange Center [CDEC], 2000–2008). Daily tidal flux through the Carquinez Strait is much greater than the freshwater flows.

The Bay Region boasts significant Pacific Coast marshes such as the Pescadero and Tomales Bay Marshes, as well as San Francisco Bay itself. San Francisco Bay is an estuary with a deep central channel, broad mudflats, and fringing marsh. The north lobe of the bay is brackish and is known as San Pablo Bay. It is surrounded by Marin, Sonoma, Napa, and Solano counties. Suisun Marsh is between San Pablo Bay and the Delta, and is the largest contiguous brackish marsh on the West Coast of North America, providing more than 10 percent of California's remaining natural wetlands. The south and central lobes of San Francisco Bay are saltier than San Pablo Bay, as the marine influence dominates.

Watersheds

[Describe the major or significant watersheds of the region. This should also include a description of existing interregional or interstate ties that the watersheds may have.]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

The California Department of Water Resources (DWR) has grouped the watersheds in the Bay Region into seven hydrologic units, as shown in Figure SFB-2. The Suisun, San Pablo, and Bay Bridges hydrologic units drain into Suisun, San Pablo, and North San Francisco Bays, respectively. The South Bay and Santa Clara hydrologic units drain into South San Francisco Bay, and the Marin Coastal and San Mateo hydrologic units drain directly into the Pacific Ocean. Figure SFB-2 also shows 16 principal watersheds in the region. The Guadalupe River and Coyote and Alameda Creeks drain from the Coast Range and generally flow northwest into San Francisco Bay. The Alameda Creek watershed is the largest in the region at 633 square miles. The Napa River originates in the Mayacamas Mountains at the northern

end of Napa Valley and flows south into San Pablo Bay. Sonoma Creek begins in mountains within Sugarloaf State Park, then flows south through Sonoma Valley into San Pablo Bay.

Groundwater Aquifers Basins

[Describe major or significant groundwater basins found in this region.]

Groundwater basins underlie approximately 1,400 square miles or 30 percent of the Bay Region, and account for about 15 percent of the region's average annual water supply. The Bay Region has 25 identified groundwater basins, as shown in Figure SFB-3. The Santa Clara Valley, Livermore Valley, Westside, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley are heavily used groundwater basins.

[GW Placeholder Text. Contains:

- Brief physical description of the significant alluvial and fractured rock (if applicable) aquifer systems within the Hydrologic Region.
- Brief description of the priority groundwater basins within the Hydrologic Region.
- Table showing the groundwater basins and subbasins within the Hydrologic Region, by their priority designations.
- Map showing the groundwater basins and subbasins within the Hydrologic Region, by their priority designations.
- Brief discussion of the well infrastructure, with an explanation of the data gaps associated with this important dataset.
- Brief and general discussion of groundwater occurrence and movement, and identification of key recharge and discharge areas, subject to availability of information.
- Map showing groundwater elevation contours with arrows depicting general direction of groundwater movement, subject to availability of information.]

Ecosystems

[Describe major or significant ecosystems found in the region.]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.
- SF Estuary Partnerships Report]

The San Francisco Bay is one of the most modified estuaries in the United States. The topography, ebb and flow tides, local freshwater and Delta inflows, and sediment availability all have been altered. Many new species of plants and animals have been introduced. These exotic and invasive species, such as the Chinese Mitten Crab and the Asian Clam, threaten to undermine the estuary's food web and ecosystem. Approximately 500 species of fish and wildlife live in the Bay Region, of which 105 wildlife species are designated by State and Federal agencies as threatened or endangered.

The land between the lowest tide elevations and mean sea level are tidal flats, which support an extensive community of invertebrate aquatic organisms, fish, plants and shorebirds. Historically; around 50,000 acres of tidal flats were situated around San Francisco Bay margins; but only about 29,000 acres remain.

Prior to 1800; the total area covered by the bay at high tide was about 516,000 acres; and another 190,000 acres on the fringe of the bay were wetlands. Today; the bay covers about 327,000 acres at high tide; and only 40,000 acres of wetlands border the bay. Almost 80 percent of the bay's historical wetlands have been lost or altered through a variety of land use changes, such as filling the bay for urban and industrial developments, and building dikes for agricultural purposes. Filling the bay has slowed significantly due to regulatory changes and the creation of the Bay Conservation and Development Commission (BCDC) in 1965, a State agency charged with permitting activities along the shore of the bay.

Channelizing and rerouting Bay Area streams for flood control has degraded or denuded riparian areas, with significant adverse impacts to aquatic and riparian habitats. Coastal streams may have an excess of fine sediments, and a lack of spawning gravels and large woody debris. Excess sediment also threatens water quality and habitat in Bolinas Lagoon, the only wetland on the West Coast that the U.S. Fish and Wildlife Service (USFWS) has designated as a Wetland of International Significance.

The Baylands Ecosystem Habitat Goals Project, a major multi-partner, multi-disciplinary project completed in the late 1990s, developed recommendations for distributing wetlands in the Bay Area, and was a catalyst for undertaking significant wetland restoration in the region. Today, the San Francisco Bay Regional Water Quality Control Board (S.F. RWQCB) provides technical input and permitting for thousands of acres of wetland and riparian restoration projects around San Francisco Bay. One of the most significant long-term projects is the South Bay Salt Pond Restoration Project; a multi-year restoration of 15,100 acres of former salt ponds in Alameda and Santa Clara Counties; and the largest wetland restoration project on the West Coast.

Other wetland restoration projects include the Napa Sonoma Marsh, Napa River Flood Control, Bair Island, Sonoma Baylands, and the Montezuma Wetland projects. The S.F. RWQCB also is working on many restoration projects on U.S. Department of Defense (DOD) sites such as Hamilton Air Force Base and Mare Island Naval Base. In addition to providing increased habitat values, the restored wetlands may act as groundwater recharge areas, flood storage areas, and buffers to sea level rise.

The S.F. RWQCB regulates wetland fills and specifies wetland mitigation, and has joined the North Coast RWQCB to develop a Stream and Wetland Systems Protection Policy that protects and restores the physical characteristics of streams and wetlands. The Policy encourages natural hydrologic regimes (the connection of stream channels, riparian areas, and floodplains) to achieve water quality standards and protect beneficial uses.

PLACEHOLDER Figure SFB-2 Principal Watersheds in the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Figure SFB-3 Groundwater Basins in the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Climate

[Describe the typical climate for the region — snowpack, seasonality of rainfall, evaporation rates, etc.]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

Like most of Northern California, the climate in the Bay Region largely is governed by weather patterns originating in the Pacific Ocean. The southern descent of the Polar Jet Stream brings mid-latitude cyclonic storms in the winter. About 90 percent of the annual precipitation falls between November and April. The North Bay receives about 20 to 25 inches of precipitation annually. In the South Bay, east of the Santa Cruz Mountains, annual precipitation is only about 15 to 20 inches because of the rain shadow effect. Historic precipitation in San Francisco since 1914 ranges from 9 to 44 inches annually, with an average of 21 inches.

The varied topography of the region creates several microclimates. Large climatic differences can occur over only a few miles. Some higher elevations in the region, particularly along west-facing slopes, average more than 40 inches of precipitation annually. The precipitation in the higher elevations typically falls as rain since the elevations are not high enough to sustain a snowpack.

Temperatures in the Bay Region generally are cool, and fog often resides along the coast. The inland valleys receive warmer, Mediterranean-like weather. Average summer high temperatures are about 80 degrees Fahrenheit, nearly 10 degrees higher than in San Francisco, resulting in higher outdoor water use. The gap in the rolling hills at Carquinez Strait allows cool air to flow from the Pacific Ocean into the Sacramento Valley. Most of the interior North Bay and the northern parts of the South Bay are influenced by this marine effect. By contrast, the southern interior portions of the South Bay experience very little marine air movement.

Demographics

[Describe the demographics for the region from the last census data available. Describe the locations and extents of disadvantaged communities in the region.]

The San Francisco Bay Hydrologic Region had a population of 6,976,224 people in the 2010 census, making it second only to the South Coast Hydrologic Region in population out of the 10 California hydrologic regions. About 17 percent of Californians live in the Bay Region, and 92 percent of the region lives in incorporated cities. The region had a growth rate of 3 percent between 2000 and 2005 (176,830 people). See Volume 5, The Technical Guide, for historical population data from 1960 to 2005. Projections of population growth and modeling of three future water use scenarios through 2050 can be found in the Looking to the Future chapter.

Land Use Patterns

[Describe the amount of land dedicated to urban, agricultural, and environmental uses and trends. Include a description of the density or intensity of urban and agricultural use of the lands, such as triple cropping, or the number of dwelling units per acre planned for the region. Sources for this information could be general plans.]

Land use in the Bay Region is truly diverse. The region is home to the world-famous Napa Valley and Sonoma County wine industries, to international business and tourism in San Francisco, to technological development and production in the "Silicon Valley", and to agriculture.

Residents live in urban, suburban, and rural areas. Some of these areas are on natural floodplains, which historically were used for agriculture. Now many residents are in the 100-year floodplain, as shown in Federal Emergency Management Agency (FEMA) maps. Growth in 100-year floodplains is being discouraged by limiting infill development through zoning restrictions and building regulations. Strategies are being developed to address population growth in densely populated urban areas, such as tax incentives to encourage urban sprawl.

Agriculture uses 21 percent of the Bay Region's land area, most of which is in the North and Northeast Bay in Napa, Marin, Sonoma, and Solano Counties. Santa Clara and Alameda counties also have significant agricultural acreage at the edge of urban development. The predominant crops are wine grapes (72 percent), fruit and nut trees, and hay production. Along the coastline south of the Golden Gate Bridge, half of the irrigated land includes specialty crops such as artichokes, strawberries, and flowers.

Federal land in the Bay Region includes Point Reyes Seashore, John Muir Wood Monument and John Muir Historic site, Golden Gate Recreation Area, Alcatraz Island, Fort Point Historic Site, Presidio of San Francisco, San Francisco Maritime Historic Park, Eugene O'Neill Historic Site, Rosie the Riveter WWII Home Front Park, and Port Chicago Naval Magazine Memorial.

Tribal Communities

[Describe tribal communities that exist in the region.]

The Bay Region historically had six Tribal groups – the Coast Miwok, Sierra Miwok, Ohlone/Coastanoan, Northern Valley Yokuts, Patwin (Southern Wintu), and Wappo, but they were forced out by the Spanish and then the Gold Rush settlers and miners. Today, descendents of these Tribes still have historical or cultural ties to the Bay Region.

The Federal government does not recognize any Indian Tribes in the Bay Region, but the Muwekma Ohlone Indian Tribe of the San Francisco Bay is seeking recognition. California government code §65352.3 requires cities and counties to consult with Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of Tribes and their representatives is maintained by the Native American Heritage Commission. Also, a Tribal Consultation Guideline, prepared by the Governor's Office of Planning and Research, is available online at http://www.opr.ca.gov/programs/docs/09_14_05%20Updated%20Guidelines%20(922).pdf.

Regional Water Management

[This subsection contains a discussion of the following topics. (Primary authors are regional entities who wish to partner with Regional Office staff, the water supply and balances work team, the integrated flood management work team, and the ecosystem planning work team.)

- A characterization of environmental water use and demands.
- Water portfolios (1998-2009).

- Change in groundwater storage.
- An updated write-up from the Update 2009 regional report flood appendix.]

(Sources of this information may be IRWM plans, statewide flood management planning report, groundwater enhancements, local agency, and portfolio data; Bulletin 118, State Water Resources Control Board, and Department of Public Health data; U.S. Army Corps of Engineers, Division of Flood Management, Federal Emergency Management Agency, Federal Energy Regulatory Commission [FERC], National Marine Fisheries Service, and operations criteria and plan [OCAP] reports; and FERC licenses.)

[Considerations for this subsection:

- Quantify water supplies, uses, quality, imports, and exports.
- Estimate uses by source, uses by sector, and other subcategories based on documented assumptions.
- If possible, indicate the level of uncertainty for reported data.
- Identify wild and scenic rivers, instream flow and Delta outflow requirements, etc.
- Describe water supply sources (groundwater, surface, recycling, desalination, regional imports, etc.) and water rights.
- Summarize agricultural, urban, and managed wetland water use.
- Compare water use and supply parameters to show effects on water availability for beneficial uses (change over time, relative fractions of total, use rates for each region, and correlated factors).
- Summarize water quality conditions.
- Describe flood management systems, risks, procedures, and responsibilities.
- Summarize key operational criteria for large regional water projects.
- Governance summary: Identify responsibility of local governments, tribal government, agencies, and institutions for managing water resources, flood protection, and wastewater.
- Provide links to detailed information in the reference guide.]

[Describe tribal participation in regional resource management.]

Water in the Environment

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

[GW Placeholder Text. Contains:

- Description of the groundwater related environmental issues for the Hydrologic Region based on connection, disconnection, or seasonal connection between the aquifer groundwater table and the local surface water systems (including wetlands), subject to availability of data.
- Description of the importance of protecting groundwater recharge areas, and potential environmental consequences associated with contaminated aquifers.]

Water is regulated in the Bay Area to support the environment for purposes such as ecosystem health, fisheries, riparian habitat, and wetlands. Several local governments and conservation groups have initiatives to improve fish passage and re-establish wetlands and habitat for fish, waterfowl, and other

species. The most important habitats around the shore of San Francisco Bay are deep and shallow bay and channel environments, tidal baylands, and diked baylands. Tidal baylands include tidal flats, salt and brackish marshes, and lagoons. Diked baylands include diked wetlands, agricultural lowlands, salt ponds, and storage ponds.

The San Francisco Bay Joint Venture (SFBJV); established under The Migratory Bird Treaty Act and funded by the Interior Appropriations Act; was created to protect, restore, increase, and enhance all types of wetlands, riparian habitat, and associated uplands throughout the Bay Region to benefit birds, fish, and other wildlife. In 2001 SFBJV published a 20-year collaborative plan for the restoration of wetlands and wildlife in the Bay Region called "Restoring the Estuary: an Implementation Strategy." This strategy laid out programmatic and cooperative strategies for accomplishing specific acreage increase goals for wetlands of three distinct types—bay habitats, seasonal wetlands, and creeks and lakes. SFBJV partners have agreed to acquire; restore; or enhance 260,000 acres of wetlands over the next two decades throughout the estuary (see San Francisco Bay Joint Venture Web site, http://www.sfbayjv.org/).

State Water Resources Control Board (State Water Board) licenses, Federal Energy Regulatory Commission (FERC) licenses, and other agreements with regulatory agencies require adequate in-stream flows to be provided below most major dams and diversions to promote the health of endangered Coho salmon (*Oncorhynchus Kisutch*), steelhead trout, and other fisheries. Coho salmon populate coastal watersheds from the Oregon border to northern Monterey Bay. The California Department of Fish and Game (DFG), with the assistance of recovery teams representing diverse interests and perspectives, created the guide, "Recovery Strategy for California Coho Salmon" (2004), to outline the process of recovering Coho salmon along the north and central coasts of California. The recovery strategy emphasizes cooperation and collaboration, recognizes the need for funding and public and private support, and maintains a balance between regulatory and voluntary efforts. Landowner incentives and grant programs are some of the many tools available to recover Coho salmon. The success of the recovery strategy depends on the long-term commitment and efforts of all who live in, or are involved with, Coho salmon watersheds.

The Ecosystem Restoration Program (ERP) conservation strategy for the Delta and the Suisun Marsh Planning Area provides leadership for conservation and restoration. It was developed by DFG in collaboration with the USFWS and the National Marine Fisheries Service. The conservation strategy is intended to facilitate coordination and integration of all resource planning, conservation, and management decisions affecting the Delta and Suisun Marsh. It is integrally linked to the Delta Vision and the conceptual models developed under the Adaptive Management Planning Team, and takes into account sea level rise projections and the effects of potential seismic events.

Water Planning and Governance

[Describe the existing water governance that exists for the region. This could be a description of the major water wholesalers, major municipal and agricultural water agencies, flood institutions, and any other governance structure that has influence on how water is managed in the region.]

[IFP Content:

- QUESTION: How does the information in this section differ from that in the Water Planning and Governance above?]

[GW Placeholder Text. Contains:

- Discussions of the various governance approaches to groundwater management within the Hydrologic Region and identification of specific GWMPs, IRWM Plans, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.
- Table listing the GWMPs, IRWMPs, groundwater ordinances, and adjudicated groundwater basins.
- Maps showing area coverage for GWMPs and IRWMPs, and "dot" locations of groundwater ordinances and adjudicated basins.]

Water governance in the Bay Region consists of a diverse body of agencies, institutions, and organizations. [Elaborate.]

DWR has accepted two Bay Region IRWM groups through its Region Acceptance Process (RAP). Figure SFB-4 shows the two groups- the San Francisco Bay Area (SFBA) and East Contra Costa County (ECCC) IRWM Groups. The SFBA Group conducts the majority of IRWM planning in the region. The ECCC Group primarily conducts IRWM planning for Eastern Contra Costa County, but a small portion of the group is within the Bay Region boundary. These groups develop IRWM plans, which are living documents that change as planning efforts mature, opportunities for collaboration and partnership are discovered, and State guidance is refined further. The water management priorities and stakeholder relationships of each group are unique, and they are committed to meeting regional water needs. The diverse stakeholder groups recognize that more regional or sub regional collaboration is needed.

The SFBA IRWM Group is developing important water management information to update its IRWM Plan, which was an important resource to develop this San Francisco Bay Regional Report. The IRWM Plan addresses 16 IRWM Plan Standards, including resource management strategies and climate change, which are discussed in the Looking to the Future chapter.

PLACEHOLDER Figure SFB-4 Integrated Regional Water Management Groups in the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The SFBA IRWM Group was formed through a collaborative process beginning in 2004. The original group participants are listed in Table SFB-2. The group is organized into four Functional Areas:

1. Water Supply & Water Quality
2. Wastewater & Recycled Water
3. Flood Protection & Stormwater Management
4. Watershed Management & Habitat Protection and Restoration

Representatives from agencies that were active in the Functional Areas formed a Coordinating Committee (CC), which serves as the governing body of the group and provides oversight for updating the IRWM Plan. The CC now includes representatives from Bay Area water supply agencies, wastewater agencies, flood control agencies, ecosystem management and restoration agencies, regulatory agencies, nongovernmental organizations, and members of the public.

The CC provides opportunities for all stakeholders and interested parties to participate in the SFBA IRWM Group and its update of the IRWM Plan. Stakeholders include water supply agencies, recycled water and wastewater agencies, stormwater and flood control agencies, utilities, watershed and habitat conservation groups, regulatory agencies, disadvantaged communities, Native Americans, environmental justice groups and communities, industrial and agricultural organizations, park districts, educational institutions, well owners, developers and landowners, elected representatives, adjacent IRWM groups, municipalities and local governments, and State and Federal agencies.

The CC has developed East, West, South, and North subregion groups because integrated water management throughout the Bay Region is challenging and can be more effective by dividing the region based on demographics and geography. The subregion groups provide stakeholder outreach and project solicitation for integration into the IRWM Plan.

The CC also has established four subcommittees to accomplish specific tasks for the SFBA IRWM Group. These subcommittees include:

1. The Plan Update Team (PUT), which is the primary work group for the IRWM Plan Update.
2. The Project Screening Subcommittee, which works with the subregion groups to obtain project proposals, reviews the proposals to ensure that they are in accordance with DWR guidelines, and identifies synergies and encourages collaboration.
3. The Website and Data Management Subcommittee, which ensures that the website is a reasonable communication and information tool for CC members and stakeholders, and ensures that the data are consistent with State requirements.
4. The Planning and Process Subcommittee, which analyzes issues and performs specific work tasks as needed, and recommends potential actions to the CC.

The CC has achieved consensus on all issues requiring a decision. However, if the CC is not able to reach consensus on an issue, then a vote may be taken. Twelve members vote- three members from each of the four Functional Areas.

PLACEHOLDER Table SFB-2 Original Bay Area Integrated Regional Water Management Group Participants

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Water Supplies

[Describe where the majority of water supplies come from in the region and from interregional and interstate sources.

- Brief description of recycled water supply/use in the region. Include discussion on annual amount of recycled water produced, how recycled water is used (ag, urban landscape, etc.), percent of wastewater that is recycled in the region. (DWR & possibly RWQCB)
- Loss of recharge areas, and issues that may be occurring with relationship to the available supply of water in the aquifer
- Groundwater level trends, and an overview of groundwater supply sustainability (based on existing management considerations).

- Provide key long-term groundwater level hydrographs for the HR with description of seasonal and long-term groundwater level trends and aquifer response to demand during wet, normal, and dry hydrologic conditions.
- Based on data availability, provide a description and graphics illustrating the estimated annual change in groundwater in storage for 2006-07, 2007-08, 2008-09, 2009-10. For HRs where this data is limited, identify as a data gap.
- If available, provide a discussion of other HR-related efforts to estimate change in groundwater in storage (local groundwater models, GRACE data)
- General overview summary of apparent aquifer sustainability based on above data and existing groundwater management practices.]

High-quality, reliable water supplies are critical to the Bay Region's prosperity and continued leadership in economic development and environmental protection. Bay Region water agencies seek to protect the quality and reliability of existing supplies through innovative water management strategies and regional cooperation. These agencies manage a diverse portfolio of water supplies, including groundwater, local surface water, Sierra Nevada water from the Mokelumne and Tuolumne Rivers, Delta water from the SWP and the CVP, recycled water, desalinated water, and transferred water.

SWP contractors and the DWR established the Monterey Agreement in 1994 to improve water management flexibility and increase the reliability of SWP deliveries during periods of water shortage. Further details about the Monterey Agreement can be found in DWR Bulletin 132-95 at http://www.dwr.water.ca.gov/swpao/bulletin.cfm.

Surface Water

East Bay Municipal Utility District (EBMUD) and San Francisco Public Utility Commission (SFPUC) import surface water into the Bay Region from the Mokelumne and Tuolumne Rivers via the Mokelumne and Hetch Hetchy Aqueducts, respectively. Additional deliveries are made from the SWP's South Bay Aqueduct (SBA) and North Bay Aqueduct (NBA); the CVP's Contra Costa Canal, Putah South Canal, and San Felipe Unit; and Sonoma County Water Agency's (SCWA) Sonoma and Petaluma Aqueducts. Reservoirs in the region capture runoff to augment local water supplies and to recharge aquifers. Some reservoirs store water at the terminus of constructed aqueducts, such as the Santa Clara Terminal Reservoir at the terminus of the SBA. Today, about 70 percent of the urban water supply is imported into the Bay Region. Table SFB-3 shows the sources of imported water, the conveyance facilities, and the volume of water that each facility delivered in 2005.

Many Bay Region residents get their water from local streams. In the South Bay, local streams supply water to the San Francisco Water Department, the City of San Jose, cities in Alameda County, and to small developments in the surrounding mountains. The Alameda County Water District (ACWD) and Zone 7 Water Agency (Zone 7) recharge their groundwater basins with local streams, as well as with deliveries from the SWP.

Local streams also play a large role in the North Bay, providing a majority of the water supply for Marin and Napa Counties. Built in 1979; Soulajule Reservoir is the newest of Marin Municipal Water District's (MMWD's) seven reservoirs; and provides 10,572 acre-feet of storage- about 13 percent of its total reservoir capacity. [Expand.]

PLACEHOLDER Table SFB-3 Sources of Imported Surface Water, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Groundwater

Groundwater is a critical component of water supply for Santa Clara Valley Water District (SCVWD), ACWD, and Zone 7 to reduce the demand on imported water. These agencies have implemented conjunctive use programs to optimize the use of groundwater and surface water resources, and water quality programs to monitor and protect groundwater quality. Additional groundwater resources are being developed throughout the region to expand the role of conjunctive use programs.

Municipal and irrigation wells range in depth from about 100 to 200 feet in the smaller basins, and 200 to 500 feet in the larger basins. Well yields typically are less than 500 gallons per minute in the smaller basins, and range from less than 50 to approximately 3,000 gallons per minute in the larger basins.

Land subsidence from groundwater pumping is a significant problem in the Santa Clara Valley groundwater basin. Subsidence has reached nearly 13 feet in some areas. SCVWD surveys hundreds of benchmarks each year and conducts numerical modeling to monitor subsidence. The 2001 SCVWD Groundwater Management Plan sets subsidence thresholds.

[GW Placeholder Text. Contains:

- Description of the major agricultural and municipal areas served and trends in the water use met by groundwater supply, such as more or less reliance on groundwater supply over time.
- Map illustrating the location of major water use met by groundwater supply.
- Table illustrating the trends in water use met by groundwater supply.
- Description of seasonal and long-term groundwater level trends, an overview of groundwater supply sustainability based on existing management considerations, and groundwater change in storage, subject to availability of information.
- Charts of selected well hydrographs illustrating the variability, challenges, and successes in groundwater management in the Hydrologic Region.]

Recycled Water

[Recycled Municipal Water: Describe recycled water use in the region. Include annual amount of recycled water use, how recycled water is used (ag, urban landscape, etc.), percent of wastewater that is recycled.]

Recycled water is used for many applications in the Bay Region, including agriculture, landscape irrigation, commercial and industrial purposes, and wetland replenishment. The region has a large potential market for recycled water- up to 240,000 acre-feet per year by 2025; as reported in the 1999 Bay Area Recycled Water Master Plan.

The Bay Region has a long history of regional recycled water planning. Following years of drought in the early 1990s, and facing uncertain future water supplies, the Bay Area Clean Water Agencies (BACWA) formed a partnership with the U.S. Bureau of Reclamation (USBR) and DWR to study the feasibility of a

regional approach to water recycling. The study produced the Bay Area Regional Water Recycling Program, which is the foundation of regional recycled water planning throughout the Bay Area.

The IRWM planning process has created partnerships among Bay Area agencies to further develop recycled water projects. The 2006 Bay Area and East Contra Costa County IRWM Plans identify over x proposed recycled water projects. Collaboration between the Bay Area and East Contra Costa County IRWM Groups intends to develop joint recycled water projects.

Through IRWM, the Bay Area Regional Water Recycling Program Authorization Act was enacted in 2008. This Act enabled USBR to fund eight recycled water projects under Title 16. The Act was expanded in 2009 to add six recycled water projects to the Federal stimulus funding list. SCVWD was awarded Federal stimulus money for two of the recycled water projects. One project is to improve the South Bay Advanced Recycled Water Treatment Facility, a joint effort between SCVWD and the City of San Jose to treat wastewater byproducts. The other project is to develop short- and long-term content for SCVWD's South County Recycled Water Master Plan. Two additional recycled water treatment facilities were dedicated recently- Las Gallinas Valley Sanitary District's facility on September 25, 2012 in San Rafael; and Novato Sanitary District's facility on October 11, 2012 in Novato.

Desalinated Water

ACWD is desalinating brackish groundwater under its aquifer rehabilitation program.

[Abandoned Marin project?]

Transferred Water

[Text to come.]

Water Uses

[The quantities of water uses will be provided in the water portfolios; however, a narrative to bring forward the story this data provides should be included here.]

[GW Placeholder Text. Contains:

- Description of the annual groundwater use/demand by beneficial use (agricultural, municipal, and managed wetlands), and by aquifer type (alluvial versus fractured rock, if applicable),
- Discussion of groundwater use as it relates to basin priority.
- Map showing groundwater use as a percentage of the overall supply for alluvial and fractured rock aquifer (if applicable) areas, with overlay of basin prioritization.]

About 70 percent of the water supply in the Bay Region is imported, and is relatively expensive due to the capital, operation, and maintenance costs of the projects that deliver the water. The high water rates, cool climate, small lot sizes, and high-density developments contribute to relatively low per capita urban water use. The City of San Francisco has a per capita use of around 100 gallons per day; ACWD 160 gallons per day; and MMWD 145 gallons per day. In contrast, water use for communities in the warmer Central Valley regions can range from 200 to 300 gallons per day.

Droughts, climate change, and population growth all could negatively impact the reliability of available water supplies. Local governments have started to require water efficient devices in new construction, and

both local governments and water agencies have rebate programs to replace older, less efficient devices such as washing machines and toilets. Some agencies are offering between $0.25 and $1.00 per square foot to remove lawn area. Most water agencies have conservation tips and rebate information on their websites, and other websites such as www.saveourh2o.org, www.h2ouse.org, and watersavinghero.com promote water conservation.

Metering water use allows water purveyors to establish tiered rates, which provide customers an incentive to minimize use and avoid the higher tiers. Purveyors also provide public education on water conservation to encourage low water use. Much of the Bay Region is well-developed and is undergoing urban renewal. The older areas of Oakland and San Francisco are being replaced by new construction, which puts into service more water efficient devices.

The S.F. RWQCB works with local water and sanitary districts to reduce the need for water imports by promoting the recycling of wastewater and the collection of stormwater in cisterns, groundwater basins, and local retention basins for safe uses in the Bay Region.

The region has an estimated 190 community drinking water systems (see Table SFB-4). Over 60% are small systems serving less than 3,300 people; with most of them serving less than 500 people. Small water systems face unique financial and operational challenges to provide safe drinking water. With a small customer base, many small water systems cannot develop or access the technical, managerial, and financial resources that they need to comply with new and existing regulations. These water systems may be geographically isolated; and their staff often lacks the time or expertise to make needed infrastructure repairs; install or operate treatment facilities; and develop comprehensive source water protection plans, financial plans, or asset management plans (United States Environmental Protection Agency 2012).

Medium and large community drinking water systems account for less than 40% of the region's systems, but deliver drinking water to over 95% of the region's population. These water systems generally have financial resources to hire staff that oversees daily operations and maintenance, and that plans for future infrastructure replacement and capital improvements to help ensure that existing and future drinking water standards are met.

PLACEHOLDER Table SFB-4 Community Drinking Water Systems, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Figure SFB-5 summarizes the total developed water supply and water use in the Bay Region from 1998 through 2005. The distribution of the dedicated water supply can change significantly depending on the wetness of the water year. More detailed numerical information about the developed water supply and water use is presented in Volume 5, The Technical Guide. The Guide shows Water Portfolio data, and the breakdown of developed water supply for agricultural, urban, and environmental purposes.

As shown in Figure SFB-5, water use in the Bay Region is predominantly urban, but environmental use for in-stream flows also is significant. Half of the urban water use is residential, and the other half is commercial and industrial. Agricultural water use is much less in this region compared to inland regions such as the Sacramento River Region, the San Joaquin River Region, and the Tulare Lake Region. For

example, agricultural water use in the SCVWD service area was less than one percent of total water use in 2005. Figure SFB-5 also shows that much of the water supply in the region is imported from other regions, while groundwater pumping is a small component of the developed water supply.

Table SFB-5 shows the total water supply available to the Bay Region from 1998 to 2005, and the estimated distribution of this water supply to all users. The annual change in the region's surface and groundwater storage also is estimated, as part of the balance between supply and use. Water can be stored in wet years, and can be taken from storage during dry years. More than half of the total water supply to the region is used by native vegetation; evaporates to the atmosphere; is used for crops and managed wetlands (agricultural effective precipitation); and flows to other states, the Pacific Ocean, and salt sinks. The remainder of the total water supply, consumptive use of applied water, is used by urban and agricultural users and for diversions to managed wetlands. Some values in Table SFB-5 were estimated because measured data were not available.

Project Operations

[Major water supply project operations can be described here, along with challenges faced in the operations. Include a description of how reservoirs and facilities are operated to meet the varied and changing demands.]

State, Federal and local canals deliver water to the Bay Region, as described in the Water Supplies section. This section describes the operation of the canals, reservoirs, and structures. The imported canal water is stored in over 30 reservoirs in the region.

SCVWD operates 10 reservoirs for water supply and groundwater recharge. The reservoirs have a total capacity of 169,000 acre-feet; the largest of which is Anderson Reservoir near the City of Morgan Hill with a capacity of 90,000 acre-feet. However, five of the reservoirs, including Anderson Reservoir, are kept low while their dams undergo seismic retrofits. Approximately 46,300 acre-feet of water storage; 27 percent of the total capacity; is lost during the retrofits which will take years. Additional water storage is lost while SFPUC's Calaveras Dam (100,000 acre-foot capacity) is retrofitted. [Other retrofits? Expand.]

PLACEHOLDER Figure SFB-5 San Francisco Bay Hydrologic Region Water Balance

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Water Quality

[Describe regional water quality related accomplishments and projects in the region. Time period 2009-2013.]

[General description of water quality conditions and major issues in the region. (RWQCB)]

[Include any relevant figure/tables to highlight water quality in the region.]

[Description of surface water quality conditions and issues in the region. (RWQCB) (include any specific constituents) Discuss any initiatives that have been undertaken to face these issues]

The S.F. RWQCB is the lead agency charged with protecting and enhancing surface water and groundwater quality in the Bay Region. It implements the Total Maximum Daily Load (TMDL) Program, which involves determining a safe level of loading for each problem pollutant, determining the pollutant sources, allocating loads to all the different sources, and implementing the load allocations. It is taking a watershed management approach to runoff source issues, including TMDL implementation, by engaging all affected stakeholders in designing and implementing goals for the watershed to protect water quality. Representatives from all levels of government, public interest groups, industry, academic institutions, private landowners, concerned citizens, and others are involved in creating watershed action plans. The plans include actions such as improving coordination between regulatory and permitting agencies, increasing citizen participation in watershed planning, improving public education on water quality and protection issues, and prioritizing and enforcing current regulations more consistently.

Surface Water Quality

Despite successful regulation of municipal and industrial wastewater discharges through the National Pollutant Discharge Elimination System (NPDES), many significant surface water quality issues remain to be resolved. Pollutants from urban and rural runoff include pathogens, nutrients, sediments, and toxic residues. Some toxic residues are from past human activities such as mining; industrial production; and the manufacture, distribution, and use of agricultural pesticides. These residues include mercury, PCBs, selenium, and chlorinated pesticides. Emerging pollutants in the region include flame retardants and pharmaceuticals. The S.F. RWQCB monitors these pollutants and takes steps to reduce them. Sanitary sewer spills can occur because of aging collection systems and treatment plants. Pollutants can spread over large areas, possibly sickening people and pets who contact them. Cleaning up pollutants after flooding is difficult.

San Francisco Bay and a number of the streams, lakes, and reservoirs in the Bay Region have elevated mercury levels, as indicated by elevated mercury levels in fish tissue. The major source of the mercury is local mercury mining and mining activities in the Sierra Nevada and coastal mountains. Large amounts of contaminated sediments were discharged into the Bay from Central Valley streams and local mines in the Bay Area. Significant impaired water bodies include the Bay, the Guadalupe River in Santa Clara County (from New Almaden Mine) and Walker Creek in Marin County (from Gambonini Mine). The S.F. RWQCB has adopted TMDLs for mercury in the Bay, Guadalupe River, and Walker Creek. Wastewater treatment plants and urban runoff also are a source of mercury, and some wetlands may contain significant amounts of methylmercury (the bioavailable form of mercury in the aquatic environment) from contaminated sediments.

The quantity and quality of biological resources has declined in San Francisco Bay because of contaminants. Fewer fish and other aquatic and riparian species reside in the Bay. Some species have significant levels of contaminants, which threaten their health and reproduction, and necessitate health advisories discouraging consumption of the species.

Non-native invasive species are considered a growing water quality threat as they have reduced or eliminated populations of many native species, disrupted food webs, eroded marshes, and interfered with boating and other water contact recreation. San Francisco Bay is considered one of the most highly invaded estuaries in the world. Exotic and invasive species, such as the Chinese Mitten Crab, New Zealand Mud Snail, Asian Clam, and Spartina (Cordgrass) threaten to alter the estuary's ecosystem and undermine its food web. The S.F. RWQCB, DFG, and other agencies have developed the *California*

Aquatic Invasive Species Management Plan, which focuses on early detection of invasive species, risk assessment of the primary introduction vectors, improved coordination among agencies, and rapid response actions.

The rate and timing of freshwater inflows are among the most important factors influencing the physical, chemical, and biological conditions in San Francisco Bay. Retaining adequate freshwater inflows to the Bay is critical to protect migrating fish and estuarine habitat. Adequate inflows are necessary to control salinity, to maintain proper water temperature, and to flush out residual pollutants that cannot be eliminated by treatment or source management.

The Sacramento and San Joaquin Rivers flow into the eastern end of Suisun Bay, contributing most of the freshwater inflows to the Bay. Many small rivers and streams also contribute freshwater. Much of the freshwater is impounded by upstream dams and is diverted to various water projects; which provide vital water to industries, farms, homes, and businesses throughout the state. The S.F. RWQCB, the Central Valley RWQCB, the State Water Board, and other stakeholders are working to improve Bay water quality by finding solutions to complex diversion issues. These agencies have formed the Bay-Delta Team to implement a long-term program that addresses impacts to beneficial uses of water in the Bay and Delta.

Another water quality problem in the Bay Region is from stream erosion, which leads to loss of riparian habitat and sediment being conveyed downstream. Stream erosion is accelerated by urbanization and additional impervious surfaces, land use conversion, rural development, and grazing. Many watersheds in the region are impaired by excessive sedimentation, a lack of large woody debris, and a lack of spawning gravels. The S.F. RWQCB addresses these issues through its stormwater program, which regulates construction activities and controls erosion from developments; through its TMDL program, which sets load limits for runoff from sources such as roads, confined animal facilities, and grazing lands; and by directing technical assistance and grant funding to locally managed watershed programs working on restoration projects and education and outreach efforts.

PLACEHOLDER Table SFB-5 San Francisco Bay Hydrologic Region
Water Balance for 1998-2005 (thousand acre-feet)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The State Water Board regulates wastewater discharged into coastal ocean waters in the Bay Region. The California Ocean Plan, which the State Water Board adopted in 1972, established water quality standards that regulate California's coastal ocean waters. The latest Ocean Plan can be viewed at http://www.waterboards.ca.gov/water_issues/programs/ocean/index.shtml.

Drinking water in the Bay Region ranges from high-quality Mokelumne and Tuolumne River water to variable-quality Delta water, which constitutes about one-third of the domestic water supply. Purveyors that depend on the Delta for all or part of their domestic water supply can meet drinking water standards, but still need to be concerned about microbial contamination, salinity, and organic carbon.

Groundwater Quality

[Describe major issues with groundwater quality for the region. To the extent possible, this should include the constituent of concern and the extent of impacts from this constituent.]

[threats such as contaminant plumes.]

[GW Placeholder Text: Content on groundwater quality will be provided by Jose Alarcon]

[Description of groundwater quality conditions and issues in the region. (RWQCB) (include any specific constituents) Discuss any initiatives that have been undertaken to face these issues]

Drought, overdraft, and pollution have impaired portions of 28 groundwater basins in the Bay Region. The basins face a perpetual threat of contamination from spills, leaks, and discharges of solvents, fuels, and other pollutants. Contamination affects the supply of potable water and water for other beneficial uses. Some municipal, domestic, industrial, and agricultural supply wells have been removed from service due to the presence of pollution, mainly in shallow groundwater zones. Overdraft can result in land subsidence and saltwater intrusion, although active groundwater management has stopped or reversed the saltwater intrusion.

A variety of historical and ongoing industrial, urban, and agricultural activities and their associated discharges have degraded groundwater quality, including industrial and agricultural chemical spills, underground and above-ground tank and sump leaks, landfill leachate, septic tank failures, and chemical seepage via shallow drainage wells and abandoned wells. The region has over 800 groundwater cleanup cases in the region, about half of which are fuel cases. In many cases, the treated groundwater is discharged to surface waters via storm drains. High priority cleanup cases include DOD sites such as Hunter's Point, Point Molate, Point Isabel, and the "Brownfields" sites (in general, these are contaminated former industrial sites in urban areas that are suitable for redevelopment).

The S.F. RWQCB contributed to the 2012 Draft Report, "Communities that Rely on Contaminated Groundwater", which assesses community drinking water systems in the region. The report identifies 28 wells in 18 community drinking water systems that rely on contaminated groundwater as a source of water. A well is considered contaminated if a primary drinking water standard is exceeded. Most of the affected systems are small systems which often need financial assistance to construct a water treatment plant or another facility to meet drinking water standards. The most prevalent contaminants are nitrate, arsenic, and aluminum.

The S.F. RWQCB issues NPDES permits for discharge of treated groundwater polluted by fuel leaks and service stations wastes, and by volatile organic compounds (VOCs). It also issues permits for reverse osmosis concentrate from aquifer protection wells, for salinity barrier wells, and for high volume dewatering of structures. As additional discharges are identified; source removal, pollution containment, and cleanup must be undertaken as quickly as possible to ensure that groundwater quality is protected.

Successful groundwater management in the Bay Region ensures that groundwater basins provide high quality water for drinking; irrigation; industrial processes; and the replenishment of streams, wetlands, and San Francisco Bay. Almost all the region's groundwater is considered to be an existing or potential source of drinking water.

Groundwater Level Trends Aquifer Conditions and Issues

[Describe the aquifer conditions, such as overdraft, loss of recharge areas, and issues that may be occurring with relationship to the available supply of water in the aquifer, including threats such as

contaminant plumes. This section could potentially be combined with groundwater quality, above, at the author's discretion.]

[GW Placeholder Text. Contains

- Key long-term groundwater level hydrographs for the Hydrologic Region with description of seasonal and long-term groundwater level trends and aquifer response to demand during wet, normal, and dry hydrologic conditions.
- Description of estimated annual change in groundwater in storage for 2005-2010, and for each pair of consecutive years (e.g., 2005-2006, 2006-07, etc.). For Hydrologic Regions where data are not available in DWR's Water Data Library or limited, identify this as a data gap.
- Map showing location of groundwater basins and associated change contours of groundwater levels and storage, subject to availability of information.
- Chart showing trends in annual and cumulative change in groundwater in storage, subject to availability of information.
- Table containing values for annual and cumulative change in groundwater levels and storage, subject to availability of information.
- Discussion and presentation of results from other related efforts for the Hydrologic Regions to estimate change in groundwater in storage, based on availability of data and information. These efforts may include local and regional agency groundwater modeling results and results from GRACE satellite analysis.
- Discussion of the historic land subsidence for the Hydrologic Region and the potential susceptibility for the future, if pertinent to the Hydrologic Region and subject to availability of data.
- General overview of aquifer sustainability based on above data and existing groundwater management practices. More detailed trends and assessment of sustainability indicators for Hydrologic Regions for which data or modeling results are available.]

Near Coastal Issues

Content from the California Ocean Protection Council's Strategic Plan is included here to highlight important near coastal issues in the Bay Region. The Plan addresses 14 important issues:

Science-based decision making

1. Improving the Use and Sharing of Scientific and Geospatial Information
2. Identifying High Priority Management Information Needs
3. Developing Strategies and Building Institutional Capacity to Incorporate Scientific Information into Management Decisions

Climate Change

5. Impacts to Coastal Communities by Storms, Erosion, and Sea-Level Rise [Sea water intrusion]
6. Ecosystem Impacts of the Changing Climate

Sustainable Fisheries and Marine Ecosystems

7. Supporting Sustainable Fisheries Management
8. Sustainable Seafood
9. Leveraging Investments and Realizing Benefits of the State's Marine Protected Areas

Coastal and Ocean Impacts from Land

10. Downstream Impacts
11. Marine Debris
12. Sediment Management
    [Sand replenishment of beaches]

Existing and Emerging Ocean Uses

13. Desalination
14. Marine Renewable Energy
15. Offshore Aquaculture

Flood Management

Flood management is a cooperative effort in which Federal, State, and local governments play significant roles. The principal flood management agencies and their roles are listed in Table SFB-6. Flood risk characterization, historic floods, and flood damage reduction measures are discussed below. A wide variety of projects and programs are implemented to reduce flood damages in the Bay Region. These include structural and non-structural measures; and disaster preparedness, response, and recovery.

Risk Characterization

[This is a summary of the risk characterization for the region. Sources for this information are Statewide Flood Management section of DWR's Strategic Planning Branch.]

The Bay Region generally receives very little snow, so floodwaters originate primarily from intense rainstorms. The northern portion of the region receives more precipitation and floods more often than the southern portion. Flooding occurs more frequently in winter and spring, and can be intense with a short duration in small watersheds with steep terrain. Valley flooding tends to occur when large, widespread storms fall on previously saturated watersheds that drain into the valley. The greatest flood damages occur in the lower reaches of streams when floodwaters spill onto the floodplain and spread through urban neighborhoods. Hillsides denuded by wildfires can exacerbate flood damages by intercepting less rainfall and generating more runoff containing massive sediment loads. Storm surges coincident with high tides can create severe flooding in low-lying areas by the mouths of rivers.

The Bay Region has over 1 million people; 550,000 acres of land; 322,000 structures; and 279 sensitive species that are exposed to flooding from the 500-year flood. The value of the exposed structures and public infrastructure totals $130 billion, but the value of exposed crops is only $20 million. The region has 150 public agencies that manage floods with 2,588 miles of levees and 222 dams and weirs. An additional 146 local projects totaling $2 billion are planned to alleviate flooding, including several projects which address coastal flooding due to sea level rise, which is a major concern in this densely populated region.

Flood hazards in the Bay Region include the following:

- Residential and commercial facilities situated in the 100-year floodplain
- New developments constructed in the 100-year floodplain without sufficient protection
- Streamside and shoreline developments prone to tidal flooding
- Reduced channel capacity because of unmanaged vegetation
- Insufficient levee heights and levee integrity threatened by burrowing rodents

- Insufficient mitigation of greater peak flows and runoff volumes from additional impervious areas in new developments
- Reduced flood storage capacity at silted reservoirs
- Aging transportation facilities threatened by unregulated streams
- Insufficient public education about flood hazards

Historic Floods

Californians have kept flood records for over 150 years. A devastating flood in 1861-1862 (the Great Flood) inundated large areas of the West Coast, including the San Francisco Bay area. Many streams in the Bay Region flood repeatedly, such as the Napa River which has flooded Napa Valley several times, causing widespread structural losses and agricultural damages. A description of historic flooding of several region streams is given below. Table SFB-7 contains details on the record floods.

Corte Madera Creek has damaged San Anselmo, Ross, Kentfield, Larkspur, Fairfax, and vicinity many times- in 1914, 1951, 1955, 1958, 1960, 1962, 1963, 1967, 1969, 1982, 1983, 1986, and 2006. The record flood occurred in 1982. The January 2006 flood caused more than $70 million in damages.

The Guadalupe River has flooded downtown San Jose and Alviso in 1862, 1895, 1911, 1955, 1958, 1963, 1969, 1982, 1986, and 1995. The river overflowed its east bank in San Jose during the February 1986 flood, inundating residences and businesses. The river overflowed again in January and March 1995. The March flood, along with high water in Los Gatos Creek, flooded about 300 homes and businesses and caused $10 million in damages.

The Napa River has flooded Napa many times since the Great Flood in 1861-1862. The January 1963 flood caused an estimated $5.5 million in damages. The February 1986 flood caused three deaths in the Napa area; destroyed 250 houses; damaged 2,500 more; forced more than 5,000 residents to evacuate their homes; and caused an estimated $2 million in damages to vineyards. In January and March 1995, towns along the Napa Valley, including downtown Napa, experienced severe flooding. In December 2002, floodwaters inundated 100 structures and caused an estimated $1 million in damages. January 2006 flood losses were estimated at $135 million throughout Napa County.

Sheet flow from the Petaluma River flooded the Denman Flat, Lynch Creek, and Payran floodplains in 1982, 1983, 1986, 1992, 1995, 1997, 1998, and 2006. The largest of the floods occurred in 1982, causing about $28 million in damages, including damages to Petaluma's wastewater treatment plant.

San Francisquito Creek has overflowed its banks several times, damaging Palo Alto. The record flood of February 1988 inundated 11,000 acres in Palo Alto; East Palo Alto; and Menlo Park; damaging 1,700 homes and businesses totaling approximately $28 million.

Sonoma Creek has flooded in the vicinity of Sonoma several times. The January 2006 flood damaged a mobile home park, a bridge, and a pipeline.

A levee failed on Alameda Creek in December 1955; sending floodwaters into portions of Niles, Centerville, Mission San Jose, Irvington, and Warm Springs. The creek flooded again in 1958; destroying crops, and damaging industries and more than 225 homes in Niles, Alvarado, and Alviso.

Severe flooding occurred on Coyote Creek in Alviso in 1982, causing more than $6 million in damages to about 360 homes and 40 businesses. In 1987 and 1988, Coyote Creek flows exceeded those of 1982, but flood damages were limited to upstream of Alviso because of flood protection in the city.

PLACEHOLDER Table SFB-6 Flood Management Agencies, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table SFB-7 Record Floods, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Flood Damage Reduction Measures

[Describe the existing damage reduction measures in place. These include structural and non-structural measures (flood control dams and reservoir operations, levees, bypass structures, local flood mitigation measures, etc.).]

[IFP Content:

- Summarize Exposure to Flood Hazard analysis performed in the Flood Future Report for the HR.
- Summarize the Risk Information Inventory evaluation performed in the Flood Future Report for the HR.
- Summarize the Flood Management Infrastructure list that was gathered as part of the Flood Future Report for the HR.
- Update 2009 RR Historic Floods subsection with information that was gathered as part of the Flood Future Report.]

Structural Measures

Structural flood damage reduction measures in the Bay Region are generally local in scope rather than part of a flood protection system serving a large area, such as the Sacramento River Flood Control System which protects the Central Valley. Important structural measures in the region; such as reservoirs, levees, and channel improvements; protect life and property from the consequences of high water and debris flow.

Three important reservoirs in the region have a designated flood protection function- Lake Chesbro, Lake Del Valle, and Cull Creek Reservoir with 3,000; 38,000; and 310 acre-feet of flood control capacity, respectively. SCVWD constructed Lake Chesbro to protect San Jose. Lake Del Valle is a SWP facility which protects Pleasanton, Fremont, Niles, and Union City. Alameda County Flood Control and Water Conservation District (Alameda County FCWCD) constructed Cull Creek Reservoir to protect Castro Valley.

The operation of the reservoirs is not coordinated according to any formal agreement. Each reservoir is operated according to its flood control diagram, which dictates the required flood space reservation throughout the flood season. The required flood space reservation is dependent on the time of year,

antecedent precipitation, and runoff forecasts. Maximum reservoir evacuation rates and objective releases also are maintained to limit downstream flooding when possible.

Many channel improvement projects in the region reduce stream flooding. These projects include channel construction, enlargement, realignment, lining, stabilization, and bank protection. U.S. Army Corps of Engineers (USACE) projects were built on Alameda Creek, San Lorenzo Creek, Walnut Creek, Corte Madera Creek, Coyote Creek, Berryessa Creek, Guadalupe River, Napa River, Wildcat and San Pablo Creeks, Green Valley Creek, Pinole Creek, Rheem Creek, Rodeo Creek, San Leandro Creek, and on several streams near Fairfield.

Other projects in the region include bank protection on San Francisco Bay near Emeryville (USACE), a detention basin on Pine Creek above Concord (Contra Costa County FCWCD), reservoirs and channel work on several tributaries of Walnut Creek in Diablo Valley (Contra Costa County FCWCD), channel improvements on lower Silver Creek in San Jose (SCVWD), channel stabilization on Cull Creek east of Castro Valley (Alameda County FCWCD), channel improvements on Conn and Tulucay Creeks (Napa County FCWCD), and locally constructed and maintained levees at Suisun Marsh and throughout the region. Table SFB-8 shows important flood control facilities in the region.

Maintenance of flood control facilities is critical to preserve the integrity of the facilities and to uphold sustained public protection. Maintenance is made difficult by two factors- adequate financing and environmental regulations. Adequate financing is hard to obtain as taxes and other sources of revenue shrink. Heightened public awareness of the environment has led to a multitude of regulations and required permits, which complicates the maintenance of facilities and increases costs. Ironically, if maintenance is deferred, new habitat might become established and then need to be protected, making maintenance even more difficult.

Reclamation Districts …… maintain USACE projects in the region, and DWR maintains Lake Del Valle. The builders of local projects, such as ….. maintain their own facilities.

PLACEHOLDER Table SFB-8 Flood Control Facilities, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Non-Structural Measures

1. Floodplain Regulation

All counties in the Bay Region have ordinances regulating floodplain development and floodplain management, typically as part of their general plan. A number of cities have additional ordinances that further restrict development in areas susceptible to flooding. Floodplain management regulations must be adopted, such as designating 100-year floodways, to reduce potential flood damages and to qualify a community for FEMA flood insurance. Officially designated floodways in the region include Cull, Crow Canyon, Alameda, and Arroyo de la Laguna Creeks in Alameda County; the Napa River in Napa County; Sonoma and San Antonio Creeks in Sonoma County; and Novato Creek in Marin County.

2.Flood Insurance

FEMA administers the National Flood Insurance Program (NFIP), which enables property owners in participating communities to purchase insurance as protection against flood losses. About 97 percent of

California communities participate in the NFIP. Of those, approximately 12 percent participate in the Community Rating System (CRS) Program, which encourages communities to go beyond minimum NFIP requirements in return for reduced insurance rates.

CRS rates communities from 1 to 10 on the effectiveness of flood protection activities. The lower ratings bring larger discounts on flood insurance. Four of the 10 Bay Region counties and 20 cities participate in CRS. As of May 2009, Contra Costa County, Milpitas, and Petaluma are in CRS Class 6; Alameda County, Solano County, Fremont, Palo Alto, San Jose, Sunnyvale, and Walnut Creek are in CRS Class 7; Concord, Corte Madera, Cupertino, Los Altos, Mountain View, Napa, Novato, Pleasant Hill, Pleasanton, San Leandro, San Ramon, and Santa Clara are in CRS Class 8; Richmond is in CRS Class 9, and Santa Clara County is in CRS Class 10. See http://www.fema.gov/business/nfip/crs.shtm for more information on the CRS system.

Quality mapping is critical to administer an effective flood insurance program, which includes developing accurate hydrologic and hydraulic modeling to delineate floodplain boundaries. FEMA has developed Flood Insurance Rate Maps (FIRMs) for all counties in the Bay Region. The FIRMs were developed in 2008, except for the San Francisco County FIRM which was developed in x.

3.Disaster Preparedness, Response, and Recovery

Many sources of data, mapping, and modeling improve flood disaster preparedness. Historic and real-time data from hundreds of stations statewide are available on CDEC. These data include river, reservoir, and meteorological data from hundreds of gages in the Bay Region. The gages are maintained by the California Department of Forestry and Fire Protection; DWR; and several other Federal, State, and local agencies. Important river gages in the region are on the Petaluma, Napa, and Guadalupe Rivers; and on Alameda and Coyote Creeks. See http://cdec.water.ca.gov for access to CDEC data. The U.S. Geological Survey (USGS) maintains and publishes stream flow records and statistics from gages nationwide. See http://waterdata.usgs.gov/nwis for access to USGS gage data.

The Federal Disaster Mitigation Act of 2000 emphasizes pre-disaster mitigation and mitigation planning. In order to receive Federal hazard mitigation funds, all local jurisdictions must adopt a hazard mitigation plan and provide technical support for executing the plan. A hazard mitigation plan identifies hazards, risks, and mitigation actions and their priorities. Alameda, Contra Costa, San Mateo, Santa Clara and Solano Counties have annexed the Association of Bay Area Governments (ABAG) Multi-Jurisdictional Hazard Mitigation Plan; while Marin, Napa and Sonoma Counties have adopted their own plans. All plans have received California Emergency Management Agency (Cal-EMA) approval. San Francisco and Santa Cruz Counties?

Many agencies in the Bay Region have some level of flood planning. The City of Napa has a system of road closures based on the stage of the Napa River which reduces the risk to individuals and property in the event of flooding. The Bay Area Flood Protection Agencies Association (BAFPAA) is a consortium of flood control and water agencies in the region that provides a forum for discussing flood issues, collaborating on multi-agency projects, and sharing resources. The Contra Costa Resource Conservation District has a watershed management plan for Alhambra Creek, which discusses a myriad of options to reduce the risk of flooding in Martinez and surrounding areas.

DWR's Awareness Floodplain Mapping program provides an easy-to-use computer interface for viewing areas vulnerable to the 100-year flood. The program supplements FEMA's NFIP by mapping areas not already covered by FIRMs. Floodplain maps are available for areas in all counties of the Bay Region, except for San Francisco County, but map coverage is expanding.

Accurate hydrologic and hydraulic models are needed to provide valuable river flow and stage forecasts that alert flood emergency personnel where flood fighting might be necessary. The National Weather Service (NWS) has an Advanced Hydrologic Prediction Service (AHPS) which forecasts weather and river flows and stages. Its California-Nevada River Forecast Center provides forecasts at four locations in the Bay Region- Coyote Creek at Coyote Reservoir, Los Gatos Creek at Lexington Reservoir, Napa River at Saint Helena, and Napa River at Napa.

The State-Federal Flood Operations Center (a joint facility of DWR and NWS) is activated early in a flood. The center issues weather and river forecasts through the California-Nevada River Forecast Center, obtains field conditions, coordinates information exchange, and recommends flood fight actions.

Under the Standardized Emergency Management System and the National Incident Management System (SEMS/NIMS), the responsible agency makes the initial response at a flood emergency site. When its resources are exhausted, the county emergency management organization provides support. If necessary, additional support is coordinated by the Coastal Region of Cal-EMA. Help can be obtained from any State agency through Cal-EMA, and possibly from Federal agencies and private organizations. DWR may request USACE involvement. Table SFB-9 lists the flood emergency responders and the priority levels at which they are activated.

Recovery after a flood may involve the funding and construction services of USACE if the damaged flood protection facility is part of a Federal project. The availability of resources to repair a flood protection facility; remove floodwater; and restore housing, businesses, and infrastructure depends on the severity of the flood and the allocation of Federal or State funds.

PLACEHOLDER Table SFB-9 Flood Emergency Responders, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Current Relationships with Other Regions and States

[This subsection contains a discussion of the following topics.

- The status and magnitude of current relationships.
- Water imports/exports.
- Recreation/tourism.]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

The Bay Region is a major importer of water supplies from other regions of California, as shown previously by Table SFB-3. The North Bay imports water from several sources including the Russian and Eel Rivers, Putah Creek, the NBA (SWP), and Vallejo Permit Water. Sonoma County Water Agency delivers water from the Russian River (North Coast Region) to Sonoma and Marin Counties through the Petaluma and Sonoma Aqueducts. The Russian River includes water that is diverted from the Eel River via the Potter Valley Project, which now diverts significantly less water following FERC relicensing.

The SWP delivers water through the NBA to Solano County Water Agency and Napa County FCWCD. The NBA extends more than 27 miles from Barker Slough to the Napa Turnout in southern Napa County. The maximum SWP entitlement is 67,000 acre-feet annually. Solano County Water Agency also gets water from Putah Creek (Lake Berryessa) via the Putah South Canal, a major component of USBR's Solano Project. The project began operating in 1959 and delivers a dependable annual supply of 207,000 acre-feet; much of which is for agricultural users in the Sacramento River Region.

The City of Vallejo obtained a water right during World War II to divert Sacramento River water from Cache Slough to supply the city and National Defense needs. The aging diversion facilities became increasingly costly to maintain, so the city opted to purchase capacity in the NBA when it was being developed. Vallejo Permit Water now is diverted from Barker Slough along with the other NBA water. The average annual diversion is 22,500 acre-feet. The old Cache Slough facilities were not abandoned and might be used for future diversions.

The South Bay imports water from the Mokelumne and Tuolumne Rivers, the Contra Costa Canal (CVP), the San Felipe Unit (CVP), and the SBA (SWP). EBMUD delivers Mokelumne River water to much of Alameda and Contra Costa Counties through the Mokelumne Aqueduct. It serves 1.4 million people with an annual water supply of about 201,000 acre-feet.

SFPUC delivers Tuolumne River water to the City and County of San Francisco via the 150-mile-long Hetch Hetchy Aqueduct. It also sells water wholesale to 28 water districts; cities; and local agencies in Alameda, Santa Clara, and San Mateo Counties. A total of approximately 250,000 acre-feet is delivered and sold annually.

The Contra Costa Water District (CCWD) delivers CVP water through the Contra Costa Canal. It has a 40-year contract for 195,000 acre-feet annually. Approximately 550,000 people receive the water; mostly in eastern Contra Costa County; but some people are in the San Joaquin River Region. CCWD also has its own water right to divert water from the Delta.

SCVWD serves 1.7 million people through the CVP's San Felipe Unit under a contract for 152,500 acre-feet annually. The keystone of the San Felipe Unit is San Luis Reservoir.

SWP water is conveyed via the SBA to SCVWD, Zone 7, and ACWD. The SBA is over 42 miles long, from the South Bay pumping plant at Bethany Reservoir to the Santa Clara Terminal Facility. The SWP water is used in the South Bay for groundwater recharge; and for municipal, industrial, and agricultural purposes. See Figure SFB-6 for a graphical depiction of Bay Region water imports, as well as Sacramento and San Joaquin River inflows and Pacific Ocean outflow.

PLACEHOLDER Figure SFB-6 Water Imports to the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Implementation Activities (2009-2013)

[This subsection contains a discussion of the actions that have been taken since the last California Water Plan update to meet the water challenges in the region.]

[Considerations for this subsection:

- The efforts we will be doing for the progress report format should provide some content for this section. We should not, however, be limited to the progress report if significant activities have occurred in the region since the last update.]

[Brief description of regional water quality related accomplishments and projects in the region. Time period 2009-2013. (RWQCB, CDPH, DWR)]

[IFP Content:

- Summarize work that was completed as part of the Flood Future Report effort, including discussion of pertinent FloodSAFE accomplishments.]

Drought Contingency Plans

[Include a description of drought-related contingency planning that has occurred since the last California Water Plan update.]

[GW Placeholder Text. Contains:

- Description of components of the local drought contingency plans that call for increased groundwater use via groundwater substitution water transfers or other conjunctive management practices, if pertinent to the Hydrologic Region.]

Resource Management Strategies

[Provide a description of any initiative or action that has taken place to implement any of the more than 27 resource management strategies during the period of this Water Plan Update 2009-2013. In your discussion, please include any links between improving water quality and habitat benefits, public health benefits, and/or water supply reliability.]

[(RWQCB, CDPH, DWR) Describe any recent initiatives or actions that have taken place from 2009-2013 to implement the 10 resource management strategies indicated below that have a primary objective to improve water quality. In your discussion, please include any links between improving water quality and habitat benefits, public health benefits, and/or water supply reliability. We also welcome discussion on recent initiatives or actions for other strategies that may provide a water quality benefit for your region.]

[Strategies with a management objective of improving water quality:

Recycled Municipal Water

Pollution Prevention

Drinking Water Treatment & Distribution

Salt & Salinity Management

Groundwater and Aquifer Remediation

Urban Runoff Management

Matching Water Quality to Use

Recharge Areas Protection

Wastewater Management (new)

Sediment Management (new)]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.
- Dot Map showing location of IFM projects.
- Table listing IFM projects.]

[GW Placeholder Text. Contains:

- Brief summary of DWR/ACWA joint survey and DWR's follow-up email and phone communications to conduct a survey to gather information on conjunctive management projects in the state.
- Description of the groundwater related conjunctive management projects for the Hydrologic Region.
- Table listing the conjunctive management projects.
- Dot Map showing location of the conjunctive management projects.
- Table showing responses on survey questions on conjunctive management projects.
- Charts showing projects by year project started, source of water, method of recharge, program goals, and potential constraints to conjunctive management, and other survey responses.
- Discussion on potential for conjunctive management in the Hydrologic Region subject to available aquifer space, source water, and infrastructure (conveyance, infiltration/injection, and extraction).
- Discussion on potential constraints to conjunctive management in the Hydrologic Region, including aquifer space, supply source, infrastructure, environmental, legal, regulatory, water quality, etc.]

Bay Region water agencies have made significant investments in programs and projects that implement various resource management strategies. Some of the resource management strategies implemented in the region since California Water Plan Update 2009 include:

- x resource management strategy (EBMUD-CCWD Raw Water Intertie). The intertie connects EBMUD and CCWD to bolster water supply reliability for customers of both agencies.
- x resource management strategy (South Bay Salt Pond Restoration).
- x resource management strategy (Regional Conservation Outreach Campaign). The campaign coordinates conservation messages throughout the San Francisco Bay Area to increase water conservation awareness.
- x resource management strategy (Alameda Creek Fish Passage Project). The project provides steelhead passage and protection at a diversion structure while maintaining local groundwater recharge operations.
- x resource management strategy (Freeport Regional Water Project). The project provides additional water supplies for EBMUD- 112,000 acre-feet in dry years to 165,000 acre-feet over 3 years?
- x resource management strategy (New Crystal Springs Bypass Tunnel). The tunnel is a critical link in delivering Sierra source water to the San Francisco Peninsula.
- x resource management strategy (Bay Area Economic Recovery Work Plan). The work plan, formulated by the Bay Area Council Economic Institute, identifies projects and activities that maximize the benefit of Federal stimulus funds.
- x resource management strategy (Napa River Flood Control Project). The project includes river widening, construction of earthen levees, concrete flood walls, sheet pile flood walls, and the creation of an Oxbow Bypass Channel.
- x resource management strategy (San Francisco Estuary Partnership Project). The project would rebuild shoreline habitat while providing flood protection from innovative designs.
- x resource management strategy (North Bay Water Quality Partnership). The project would address sediment and pathogen TMDLs in Sonoma Creek; loss of tidal marsh, Clapper Rail, and Salt Marsh Harvest Mouse in Corte Madera Creek; loss of Steelhead in Corte Madera and Sonoma Creeks; and stormwater quality near the City of Sonoma and in the Corte Madera Watershed.
- x resource management strategy (Ora Loma Ecotone Project). The project would restore historical ecotone functions to San Francisco Bay by maintaining sufficient upland buffer areas around tidal wetlands, restoring and conserving rare and valuable habitats, and by denitrifying wastewater to improve Bay water quality

Water Planning and Governance

[Describe any changes made to the water governance in the region since the last California Water Plan update. This would include any joint powers agreements and IRWM groups formed.]

[Describe new activities that government agencies, water districts, and planning organizations are doing in the region since California Water Plan Update 2009.]

[More complete information on water governance will be developed for California Water Plan Update 2013. This will include identification of local, State, Tribal, and Federal government agencies and institutions that are responsible for managing the region's water resources, flood protection, and wastewater.]

[IFP Content:

- Verify existing list of IRWM regions and location maps are up-to-date based on information gathered as part of the Flood Future Report.]

[GW Placeholder Text. Contains:

- Brief description of the groundwater governance associated with the various GWMPs, IRWMPs, conjunctive management projects, groundwater recharge projects, groundwater monitoring, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.
- Table listing the above groundwater-related governance within the Hydrologic Region.
- Maps showing area coverage for GWMPs and IRWMPs, and "dot" locations of groundwater ordinances, adjudicated basins, and conjunctive management projects.
- Groundwater basin prioritization maps showing high, medium and low priority basins]

State Funding Received

[Describe the State funding received to implement water-related infrastructure, coordination, or planning in the region.]

[IFP Content:

- If pertinent to HR, update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

- Prop 84 Planning Grant MMWD $842,556 Dec 7, 2011-Dec 31, 2013
- Prop 84 Interregional Grant EBMUD $10,000,000 Jul 28, 2010-Sep 4, 2014
- Prop 84 Implementation Grant BACWA $30,093,592 May 11, 2012-Sep 30, 2016
- Prop 1E Stormwater Flood Management Grants
  - MCFCWCD $7,661,000
  - SFPUC $24,147,000
  - SCVWD $25,000,000 Sep 18, 2012-Jun 30, 2016
  - San Francisquito Cr JPA $8,000,000

Local Investment

[Describe the local investment made to implement water-related infrastructure, coordination, or planning in the region.]

[IFP Content:

- If pertinent to HR, update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

[Cost Share (in-kind service and matching funds) for above grants]

Water Conservation Act of 2009 (SB x7-7) Implementation Status and Issues

[Provide a discussion of the status and major issues with implementation of the Water Conservation Act of 2009 for both urban and agricultural water conservation.]

Fifty-one urban water management plans from Bay Region water agencies were reviewed to evaluate compliance with the Water Conservation Act of 2009 (SB x7-7). The Act calls for a 20 percent reduction in water use per capita by December 31, 2020. The urban water management plans indicate that the average water use of the 6,976,224 people in the Bay Region (2010 census) was 156 units per capita in 2010. Water use has dropped by 5.9 percent since passage of the Act in 2009, but still needs to drop another 14.1 percent to reach the 2020 target of 134 units per capita.

Interregional and Interstate Activities

[Describe those interregional and interstate activities that have occurred since the last California Water Plan update.]

[GW Placeholder Text. Contains:

- Description of interregional and interstate water resource planning activities that have identified increase use of groundwater in their planning (interstate examples include Klamath Basin for the North Coast Hydrologic Region, and the Honey Lake Basin for the North Lahontan Hydrologic Region).]

Looking to the Future

[Notes: (1) Although the regional forums may seek consensus on objectives for the entire hydrologic region, this section will likely be a compilation of the IRWM and other local plan objectives. (2) Reference statewide priorities or IRWM guidelines to ensure consistency. (3) Because no single resource management strategy can meet the broad set of resource management objectives, this section is meant to shift planning approach/discussions from focusing on specific types of resource management strategies (e.g., desalination vs. conservation vs. storage, etc.) to an objectives-based planning approach.]

Future Conditions

Future Scenarios

[This subsection contains a discussion of the following topic. (Primary authors would be from the analytical data and tools work team.)

- Water demand by sector for future scenarios.]

[Considerations for this subsection:

- How do the three future scenarios relate to regionally derived future plans/visions? This might be the best place to examine compatibilities and contrasts of local and state objectives.
- Regional estimates regarding future agricultural, urban, and environmental water demands; economic development; flood management; land use; etc.]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report.]

DWR evaluated ways to manage water in the Bay Region for different assumed future scenarios. The ultimate goal was to see which regional responses (combinations of resource management strategies)

provide effective water management for the alternative future scenarios. Effective water management includes sustaining natural resources and reducing flood risk. See Box SFB-2 for scenario descriptions.

Total Demand Change

The total water demand change in the Bay Region is shown in Figure SFB-7 for each scenario. The change in water demand was computed as the difference between the historical average (1998–2005) and the future average (2043–2050) water demands. Future water demand is shown with climate change (hatched bars) and without climate change (solid bars). The figure indicates that the Expansive Growth, Current Trends, and Slow & Strategic Growth scenarios increase water demand (without climate change) by 765,000; 400,000; and 40,000 acre-feet; respectively. The figure also indicates that the Expansive Growth scenario has the largest increase in water demand (with climate change); between 800,000 and 900,000 acre-feet.

Urban Demand Change

Figure SFB-7 also shows the urban water demand change in the Bay Region with and without climate change for the Expansive Growth, Current Trends, and Slow & Strategic Growth scenarios. Without climate change, Expansive Growth and Current Trends have an increase in urban water demand of 800,000 and 350,000 acre-feet; respectively. Slow & Strategic Growth has a reduction in urban water demand of about 165,000 acre-feet. With climate change, Slow & Strategic Growth has a smaller reduction in urban water demand of between 130,000 and 165,000 acre-feet.

Agricultural Demand Change

The agricultural water demand change in the Bay Region also is shown in Figure SFB-7. Agricultural water demand generally is less because of a reduction in irrigated acreage and an increase in water conservation. Without climate change all three scenarios show the same reduction in agricultural water demand (about 35,000 acre-feet), but with climate change the reduction is somewhat less.

Environmental Demand Change

Finally, Figure SFB-7 shows the environmental water demand change in the Bay Region. Without climate change, Current Trends and Slow & Strategic Growth have an increase in environmental water demand of 83,000 and 250,000 acre-feet; respectively. With climate change, Current Trends and Slow & Strategic Growth have an even greater increase in environmental water demand because of the warmer and drier climate. Expansive Growth would not have an increase because of the assumption that only current environmental water commitments would be maintained.

PLACEHOLDER Box SFB-2 Scenario Descriptions

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Figure SFB-7 Water Demand Changes in the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Climate Change

[Increased crop water needs]

[Reduced water management flexibility]

[More extreme weather events; flooding and drought]

[Rising sea levels- Salt intrusion into groundwater]

[Changes in timing of water availability; Delta pumping restrictions]

[Increased expense of freshwater conveyance; greater pumping distances]

[Increased vulnerability of regional potable water availability]

[Groundwater depletion and scarcity during droughts]

[More intense wildfires and their impacts to watersheds]

[Promote valuation of ecosystem services (e.g. intact ecosystems = adaptation; ecosystem services such as sequestration = mitigation)]

[Link sustainability with conservative use of resources for future flexibility]

Climate change impacts observed in California in the past 100 years include a 1oF increase in average temperature, a 10% decrease in the average early snowpack in the Sierra Nevada, and a 7-inch rise in the mean sea level at the Golden Gate Bridge in San Francisco Bay (DWR 2008). Climate change already is impacting many resource sectors in California, including water, transportation and energy infrastructure, public health, biodiversity, and agriculture (CNRA, 2009). Intergovernmental Panel on Climate Change (IPCC) models of 21st-century climate scenarios project increasing temperatures in California, with greater increases in the summer (Cayan, 2008). Annual precipitation is projected to change across California, resulting in altered surface runoff timing and volume. Vulnerabilities and risks from current and anticipated future changes are best assessed on a regional basis due to the economic, geographical, and biological diversity of the State. While the State is taking aggressive action to mitigate climate change through greenhouse gas (GHG) reduction and other measures (CARB, 2008), global impacts from carbon dioxide and other GHGs that already are in the atmosphere will continue to impact climate through the rest of the century (IPCC, 2007). Implementing adaptation measures sooner rather than later can achieve resilience to an uncertain future. Many resources are available to assist water managers and others evaluate their region-specific vulnerabilities, and to identify appropriate adaptive actions (USEPA and DWR 2011; Cal-EMA and CNRA 2012).

Regional Temperature Trends

Temperature data for the past century is available from the Western Regional Climate Center (WRCC). (Through an analysis of NWS Coop Station and PRISM Climate Group gridded data, scientists from the WRCC have identified 11 distinct climate regions across the State. These 11 climate regions describe climate trends within the State (Abatzoglou et al, 2009). DWR's hydrologic regions do not correspond

directly to WRCC's climate regions. A hydrologic region may overlap more than one climate region, and hence have different climate trends in different areas.)

The Bay Region overlaps the WRCC Central Coast and Sacramento-Delta Regions, and also small portions of the WRCC North Coast and North Central Regions. Mean temperatures in the Central Coast Region have increased about 1.1-2.0°F (0.6-1.1°C), with minimum values increasing more than maximums [1.6-2.6 °F (0.9-1.4 °C) and 0.4-1.5°F (0.2-0.8°C), respectively]. Inland, temperatures in the Sacramento-Delta Region show a similar warming trend. A mean increase of 1.5-2.4°F (0.8-1.3°C) was recorded, with minimum temperatures increasing 2.1-3.1°F (1.2-1.7°C) and maximum temperatures increasing 0.7-1.9°F (0.4-1.1°C).

Temperature and Precipitation Projections

A recent study by Scripps Institution of Oceanography uses the most sophisticated methodology to date, and indicates by mid-century (2060-2069) temperatures will be 3.4 -4.9o F (1.9 -2.7oC) higher across the State than they were from 1985 to1994 (Pierce et al, 2012). In the Bay Region, the study projects that annual temperatures will increase 3.6-4.1oF (2.0-2.3oC), with a 2.9-3.1oF (1.6-1.7oC) increase in winter temperatures and a 4.1-5.2oF (2.3-2.9oC) increase in summer temperatures. Climate projections for the Bay Area from Cal-Adapt indicate that the temperatures between 1990 and 2100 will increase by as much as 4-5oF (2.2-2.8oC) in the winter and 5-6oF (2.8-3.3oC) in the summer (Cal-EMA and CNRA 2012).

Future changes to annual precipitation across California will be in timing, amount, and type (rain or snow). Climate model precipitation projections for the State do not all agree, but most anticipate drier conditions in the southern part of California, and wetter conditions in the North, including warmer winter precipitation. Extreme precipitation events are projected to increase with climate change. A recent study projects that the flood risk from warm and wet, atmospheric river storms could be greater than the historic flood risk, as storm seasons that are more extreme than historically develop occasionally (Dettinger, 2011). Since less scientific information on localized precipitation changes exists, adapting to this uncertainty is necessary at the regional level. (Yun et al, 2010).

Given these projections, climate change is anticipated to present significant water resource management challenges to the Bay Region. Approximately 70% of the region's water supply is imported, and the majority of the imported water originates in the Sierra Nevada. The Sierra Nevada snowpack is expected to continue to decline as warmer temperatures raise snow levels, reduce spring snowmelt, and increase winter runoff; reducing water supplies for over 7 million people and agriculture in the region. DWR projects that the Sierra Nevada will experience a 25% to 40% reduction of its historic average snowpack by 2050 (DWR, 2008).

Infrastructure and Ecosystem Services

Coastal observations and global model projections indicate that the California coast and estuaries will experience increasing mean sea levels during the next century, which will significantly affect development and infrastructure in the Bay Region. Mean sea levels are projected to rise 5 to 24 inches (12-61cm) by 2050 and 17 to 66 inches (42-167cm) by 2100 (NRC 2012). A 55-inch rise in mean sea level would place an estimated 270,000 people in the Bay Area at risk from flooding; 98% more than are currently at risk; and put an estimated $62 billion worth of shoreline development at risk; including major transportation infrastructure such as rail lines, freeways, and airports (BCDC 2011). Also, the expected

increase in both the intensity and frequency of storms will increase the risk of flooding in the Bay Region, from both larger storm surges and greater stream runoff.

Climate changes also are expected to substantially alter the Bay ecosystem. Wetland and transitional habitats will be vulnerable to inundation, erosion, and changes in sediment supply. The highly developed shoreline will constrain the ability of these habitats to migrate landward (BCDC 2011). These habitat changes, along with changes to freshwater inflow and water quality, will impact the species composition in the Bay.

Adaptation

As the science of climate change quickly develops and evolves; local, state, and federal agencies face the challenge of interpreting new information and determining which methods and approaches are appropriate for their planning needs. The Climate Change Handbook for Regional Water Planning (USEPA and DWR 2011) provides an analytical framework for incorporating climate change impacts into a regional and watershed planning process, and considers adaptation to climate change. The handbook provides guidance for assessing the vulnerabilities of California's watersheds and regions to climate change impacts, and prioritizing these vulnerabilities.

Additional Tools and Resources

The State of California has developed additional tools and resources to assist resource managers and local agencies in adapting to climate change, including:

- *California Climate Adaptation Strategy* (2009) - California Natural Resources Agency (CNRA) at: http://www.climatechange.ca.gov/adaptation/strategy/index.html
- *California Climate Adaptation Planning Guide* (2012) - California Emergency Management Agency (Cal-EMA) and CNRA at: http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html
- Cal-Adapt website at: http://cal-adapt.org/
- Urban Forest Management Plan (UFMP) Toolkit - sponsored by the California Department of Forestry and Fire Management at: http://ufmptoolkit.com/
- California Climate Change Portal at: http://www.climatechange.ca.gov/
- DWR Climate Change website at: http://www.water.ca.gov/climatechange/resources.cfm
- The Governor's Office of Planning and Research (OPR) website at: http://www.opr.ca.gov/m_climatechange.php

The myriad of resources and choices available to water managers can seem overwhelming. However, managers can implement many proven strategies to prepare for climate change in the Bay Region, regardless of the magnitude of future warming. These strategies often provide multiple benefits. For example; developing "living shorelines", an approach that integrates subtidal habitat restoration with adjacent tidal and riparian areas to benefit multiple species; also can improve water quality, increase wave attenuation, and reduce shoreline erosion and flooding. Other adaptation measures include water use efficiency, wetland restoration, coastal armoring, elevated development, floating development, and in some cases, managed retreat.

Strategies

Many of the resource management strategies found in Volume 3 not only assist in meeting water management objectives, but also provide benefits for adapting to climate change. These strategies include:

- Agricultural and Urban Water Use Efficiency
- Conveyance – Regional/Local
- System Reoperation
- Desalination
- Recycled Municipal Water
- Surface Storage – Regional/Local
- Pollution Prevention
- Agricultural Lands Stewardship
- Ecosystem Restoration
- Land-Use Planning and Management
- Watershed Management
- Integrated Flood Management

Water managers need to consider both the natural and built environments as they plan for the future. Stewardship of natural areas and protection of biodiversity are critical for maintaining ecosystems, which can benefit humans by carbon sequestration, pollution remediation, and flood risk reduction. Increased collaboration between water managers, land-use planners, and ecosystem managers can identify common goals and actions that are needed to achieve resilience to climate change and other stressors. While both adaptation and mitigation are needed to manage climate change risks and often are complementary, unintended consequences may arise if these efforts are not coordinated (CNRA, 2009).

Local Planning

Numerous efforts in the Bay Region are addressing climate change. Two recent policy efforts include the BCDC Climate Change Bay Plan Amendment, and the California Coastal Conservancy Climate Change Policy and Project Selection Criteria. Planning efforts in the region include the Bay Area IRWM Plan Update; the SFEI Baylands Ecosystem Habitat Goals Climate Change Technical Update; and the Plan Bay Area Project, which links land-use and transportation planning in the region. Numerous studies and pilot projects also are underway, including Adapting to Rising Tides, Our Coast Our Future, San Francisco Living Shoreline, San Francisco Estuary Pilot, and the Innovative Wetland Adaptive Techniques in Lower Madera Creek Project. Collaborative groups such as the Bay Area Ecosystem Climate Change Consortium, the North Bay Climate Adaptation Initiative, and the San Francisco Conservations Commons also are working to bring together technical experts, scientists, natural resource managers, and policymakers to better understand and address the impacts of climate change on Bay Area ecosystems and communities.

The Bay Region contains a diverse landscape with different climate zones, which makes finding one adaptation strategy that works throughout the region difficult. Water managers and local agencies must work together to determine the appropriate adaptation strategy and planning approach for their community. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (USEPA and DWR, 2011). However, the status-quo likely will need to be augmented with new approaches (Milly et.al, 2008).

Whatever approach is used, water managers and communities must implement adaptation measures sooner rather than later to be prepared for an uncertain future.

IRWM planning is a framework that allows water managers to address climate change on a smaller, more regional scale. Climate change now is a required component of all IRWM plans (DWR 2010). IRWM regions must identify and prioritize their specific vulnerabilities to climate change, and identify the adaptation strategies that are most appropriate. Planning and adaptation strategies that address the vulnerabilities should be proactive and flexible, starting with proven strategies that will benefit the region today, and adding new strategies that will be resilient to the uncertainty of climate change.

Mitigation

[Provide information (graphical and text) on the energy intensity of raw water extraction and conveyance, by region, for each water type in the butterfly diagram.]

[Describe strategies to reduce the GHG intensity of water use, and other related pertinent information on the water-energy nexus.]

Mitigating for climate change by reducing the greenhouse gas (GHG) emissions related to water use is important. By comparing the energy intensities of various water supplies, responsible water portfolio choices can be made. This is the first California Water Plan to include the energy intensities of water supplies.

Figure SFB-8 shows the relative energy intensities of raw water extraction and conveyance for the primary water supply sources in the Bay Region (caption and footnotes under development). It is a tool to assist water managers to select an energy efficient water supply portfolio that can be used to meet demand in the Bay Region.

PLACEHOLDER Figure SFB-8 Energy Intensity of Raw Water Extraction and Conveyance in the San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Interregional and Interstate Planning Activities

[This subsection contains a discussion of the following topics.

- A summary of relevant planning or implementation activities that will affect this region.
- Regional stake in process.
- Strategies for regional self-sufficiency: Define goals and purpose of self-sufficiency.]

[Considerations for this subsection:

- Consider listing Update 2009 objectives to reflect statewide objectives/vision:
  - Reduce Water Demand.
  - Improve Operational Efficiency and Transfers.
  - Increase Water Supply.
  - Improve Water Quality.
  - Practice Resource Stewardship.

- Improve Flood Management.
- BDCP?]

[IFP Content:

- When appropriate, Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report. Flood Risk Characterization]

[This subsection contains a discussion of the following topics. Statewide flood planning risk characterization by region (primary authors would be Statewide Flood Management Planning Program staff).]

[IFP Content:

- Summarize the recommendations developed as part of the Flood Future Report (It is anticipated that this summary will be the consistent throughout all of the RRs).
- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report]

Future Vision

Regional Future Vision

[This subsection would describe the desired future condition that the local stakeholders have for this region. Concepts such as regional water self-sufficiency, flood protection from a 100-year flood, conservation goals, and land use goals could be described here.]

Bay Region goals:

- Promote economic, social, and environmental sustainability
- Improve water supply reliability
- Protect and improve hydrologic (watershed) function
- Protect and improve the quality of water resources
- Protect public health, safety, and property
- Create, protect, enhance, and maintain environmental resources and habitats

DFG envisions future ecosystem improvements in the Bay Region that achieve one or more of the following objectives:

- Improve aquatic habitat, including deep and shallow open water
- Offset, mitigate, or accommodate climate change issues such as sea level rise, temperature shifts, and regime changes
- Acquire conservation easements on lands
- Protect or restore fish habitat by improving fish passage, hydrology, fish screens, and gravel augmentation
- Restore floodplain hydrodynamics to benefit listed species
- Develop and publish instream flow data, including minimum and recommended instream flow requirements
- Prevent or reduce negative impacts from invasive non-native species; including those associated with water supply and conveyance projects such as quagga and zebra mussels, *egeria densa*, water hyacinth, and others

- Monitor the population of Lamprey species
- Improve the habitat of listed fish species
- Establish environmental baselines (water quality, habitat, populations, etc) and develop monitoring programs
- Restore perennial grasslands
- Reduce predation loss of juvenile fish and fish entrapment
- Improve habitat and increase populations of salmon, especially Coho
- Restore riparian habitat and preserve riparian corridors
- Restore saline emergent wetlands and tidal marshes
- Improve the transparency and availability of environmental data
- Improve water quality to support healthy ecosystems (sediment, oxygen saturation, pollution, temperature, etc)
- Restore, preserve, and protect wildlife corridors

Projects that incorporate one or more of these objectives, which often are interrelated, would improve the Bay Region ecosystem. DFG regional staff compiled these objectives from various State plans such as the DFG Conservation Strategy and the State Wildlife Action Plan. Additional State plans are listed in the References.

Tribal Objectives/Vision

[Objectives and vision of the tribal interests in the region would be described here.]

Relevant Statewide Interests and Objectives

[Describe statewide interests and objectives and how they might influence or affect the region. State government initiatives would be discussed in relation to the region.]

Regional Water Planning and Management

[This subsection contains a discussion of the following topics.

- Discussion of (1) status of IRWM or other regional plans, highlighting key challenges and accomplishments; and (2) regional response strategies for meeting future water demands and quality standards, adapting to climate change, and achieving sustainability.]

(Information sources may be IRWM plans, urban water management plans, agricultural water management plans, groundwater management plans, water elements of general plans, floodplain management plans, stormwater plans, RWQCB basin plans and water quality reports, watershed management plans, habitat conservation plans, multi-species conservation plans, etc.)

[Considerations for this subsection:

- Review IRWM and other regional plan coverage, quality, level of integration, and next steps toward implementation.
- Identify needed improvements in IRWM plan coverage, participation, and integration across resource areas, institutions, watersheds, and methods.
- Showcase successful regional projects from IRWM plans.
- Summarize FloodSAFE's regional flood management plans and describe challenges and recommendations.

- Summarize RWQCB regional water quality plans and describe challenges and recommendations.
- Describe intraregional planning and management, challenges, and benefits.
- Review drought preparedness based on region and local plans.]

Integrated Regional Water Management Coordination and Planning

[Review IRWM and other regional plan coverage, quality, level of integration, and next steps toward implementation.]

[Identify needed improvements in IRWM plan coverage, participation, and integration across resource areas, institutions, watersheds, and methods.]

[Elaborate on Zone 7 (Carol Mahoney) integration of Flood and Water Supply Planning Programs which helps identify and develop integrated multi-beneficial projects.]

[IFP Content:

- Verify existing list of IRWM regions and location maps are up-to-date based on information gathered as part of the Flood Future Report.
- Summarize IFM Management Actions developed as part of the Flood Future Report.
- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report
- SFBA and ECCC IRWM Groups have identified x and y flood control projects, respectively.]

Challenges

[Provide a discussion of the challenges faced in the section "Regional Water Planning and Management."

- Brief description of major water quality challenges in the region and actions currently undertaken or that need to be undertaken to address these challenges. (RWQCB, CDPH, DWR)]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report]

[GW Placeholder Text. Contains

- Summary of the number of GWMPs that are not SB1938 compliant, or only partially SB 1938 compliant. The challenges associated implementing the SB 1938 groundwater management criteria, and recommendations for improving or incorporating sustainable practices into local groundwater management.
- Map showing high priority basins for the Hydrologic Region those do not have SB 1938 compliant GWMPs. The map shows overall area without compliant groundwater management planning, not area of individual groundwater basins.
- Summary of lessons learned from various Case Studies.]

Some major water challenges facing the Bay Region include providing reliable water supplies, especially during droughts and other emergency outages; maintaining or improving drinking water quality; protecting drinking water sources; improving the health of the San Francisco Bay ecosystem; linking local

land use planning with water system planning; improving water management planning; managing floodplains amid urban development and high land costs; satisfying environmental water demands; and improving water quality in receiving waters.

Recurring floods are a problem throughout the Bay Region. Lives, homes, businesses, farmlands, and infrastructure are frequently at risk. Some particularly vulnerable locations in the region are on the Guadalupe, Napa, and Petaluma Rivers; and on Coyote and Corte Madera Creeks. San Anselmo, Napa, and some communities in Santa Clara County are subject to frequent flooding. Levees are inadequate on tributaries of Alameda Creek, and railroad bridge openings are too small on major urban streams. Developed bay and coastal areas are vulnerable to sea level rise, tidal floods, and storm surges. Undesirable vegetation and beaver colonies in urban floodways is another significant challenge. Wildfires can denude steep erodible slopes in canyons and upland areas above urban development. The ensuing winter rains can flood developments with large debris flows, causing severe damage to structures and leaving large quantities of sediment and other detritus. Don Castro Reservoir is problematic. [Elaborate.] Providing better protection for lives and property remains the definitive flood management challenge.

Effective flood preparedness is another challenge. It requires accurate evaluation of flood risk; adequate measures to mitigate flood damage; sufficient preparation for response and recovery; and effective coordination among local, State, and Federal agencies. Completion of floodplain mapping, both the FEMA FIRMs and the complementary DWR Awareness Floodplain Mapping, will provide much needed information to evaluate flood risk. Mitigating flood damage may take many forms, including governmental regulation of construction and occupancy in flood-prone areas, flood-proofing, and structural protection such as levees. Response and recovery preparedness improves with the use of flood warning systems, and with formal agreements that specify agency responsibilities and funding. Successful coordination between local, State, and Federal agencies enhances sharing of watershed resources, maintenance of streams, community awareness of local flood risks, sustainability of the Delta water supply, and protection of infrastructure from levee failure.

Local funding for flood management and for flood maintenance and construction projects has become less effective in recent years because of several factors:

- Increased protection of the environment has increased maintenance and construction costs.
- Concern for endangered species has hindered project scheduling.
- Environmental and endangered species permitting has been difficult to obtain.
- Measures to reduce taxes, especially property tax, have hindered raising sufficient revenue.
- Inflation has increased maintenance and construction costs.

Procuring adequate funding is difficult with these funding constraints, which makes certifying levees that meet FEMA or USACE standards, and assessing the condition of flood control facilities quite challenging.

Drought and Flood Planning

[Highlight discussion of the areas of water planning and management related to the extremes, drought and flood.]

FloodSAFE is a strategic DWR initiative that seeks a sustainable integrated flood management and emergency response system throughout California to improve public safety; protect and enhance

environmental and cultural resources; and support economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and reducing flood damages. FloodSAFE is guiding development of regional flood management plans. These plans will encourage regional cooperation in identifying and addressing flood hazards, and will include risk analyses, review of existing flood protection measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans.

Resource Management Strategies

[Note: (1) Align with resource management strategy impacts and benefits of IRWM standards. (2) Information for this section will be regionally derived. The "statewide" strategies (i.e., the updated text from Volume 2 of Update 2009) will be published in a separate volume, not in these regional reports.]

Strategy Availability

[New for Water Plan Update 2013, we plan to show the applicability and potential of the Resource Management Strategies in each region.]

[This subsection contains a discussion of the following topics.

- Subset of 27 strategies that are potentially applicable within each region.
- Estimate of benefits that could be achieved considering all constraints (e.g., institutional regulatory, finance, local opposition, technology, conveyance, local land use, etc.).]

[(RWQCB, CDPH, DWR) Identify all the water quality related resource management strategies that are potentially applicable for your region (even if they have not been implemented). Provide an estimate of the benefits that could be achieved (if the strategy were fully implemented) considering all constraints (e.g., institutional regulatory, finance, local opposition, technology, conveyance, local land use, etc.) In your discussion, include any links between improving water quality and habitat benefits, public health benefits, and/or water supply reliability.]

[We also welcome discussion on other strategies that if implemented may provide a water quality benefit for your region.]

Table SFB-10 lists the 27 resource management strategies and their applicability in the Bay Region, as indicated by the SFBA IRWM Group. X strategies have the potential to benefit water management in the region, and are discussed further in the next section.

PLACEHOLDER Table SFB-10 Applicability of Resource Management Strategies, San Francisco Bay Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Regional Strategies

[This subsection contains a discussion of the following topics.

- Regional response packages for managing future water supply, managing flood risk, managing water quality, adapting to climate change, and achieving sustainability.]

[Considerations for this subsection:

- Highlight response strategies important to the region.
- This section will inform the strategy and policy recommendations in Volume 1 of the Update 2013 as themes become evident.
- Number of accepted plans.
- Briefly discuss a regional response package for managing water quality, and discuss why improving water quality is important to your region. (RWQCB)]

[IFP Content:

- Update 2009 RR information for this subsection from information gathered as part of the Flood Future Report]

[GW Placeholder Text. Contains:

- Discussion of the various existing groundwater related management strategies as it relates to groundwater management plans and IRWM plans, as well as conjunctive management projects and groundwater recharge projects, etc.
- Table listing the existing groundwater related management strategies.]

x promising resource management strategies were identified in Table SFB-9. [These include …..]

Urban Runoff Management

The S.F. RWQCB, the San Francisco Estuary Project, municipal storm water agencies, and other partners promote Low Impact Development (LID) in the Bay Region. LID is a design approach that manages storm water runoff to replicate pre-development hydrology. It promotes using natural on-site features to protect water quality and detain runoff.

See the Urban Runoff Management Resource Management Strategy in Volume 3 for additional LID information.

Pollution Prevention

The S.F. RWQCB designates TMDLs for Bay Region watersheds to limit pollutants that impair water quality (primarily sediments, pathogens, nutrients, mercury, polychlorinated biphenyls, and urban pesticides). The TMDL designations help the region meet its goals of improving watershed and habitat management.

References

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[IFP Content:

- Flood Future Report will be main reference. Any other necessary references will be provided by the IFP team.]

[GW Placeholder Text. Contains:

- References for all cited materials in the text.]

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Challenges

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Personal Communications

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[GW Placeholder Text. Contains

- Additional information regarding methods and assumptions related to the groundwater-related data and analyses provided.]

Table SFB-1 Water Governance, San Francisco Bay Hydrologic Region

Organization	Legal status	Purpose
Local water and wastewater agencies and districts	Local government	Water storage and delivery, wastewater treatment
Importing water agencies (EBMUD, HHW&P, SWP, CVP, and others)	Local government, state and federal projects	Water storage and delivery, wastewater treatment, flood management
City and county governments	Local government	Water delivery, wastewater treatment, flood management, land use zoning
Regulating agencies (SWRCB, S.F. RWQCB, DPH, DSOD, FERC, and others)	State and federal government	Regulation of water diversions, water quality, hydroelectric projects, dam safety

Table SFB-2 Original Bay Area Integrated Regional Water Management Group Participants

Organization
Alameda County Water District
Association of Bay Area Governments
Bay Area Clean Water Agencies
Bay Area Water Supply and Conservation Agency
Contra Costa County Flood Control and Water Conservation District
Contra Costa Water District
East Bay Municipal Utility District
Marin Municipal Water District
City of Napa
North Bay Watershed Association
City of Palo Alto
San Francisco Public Utilities Commission
City of San Jose
Santa Clara Basin Watershed Management Initiative
Santa Clara Valley Water District
Solano County Water Agency
Sonoma County Water Agency
Sonoma Valley County Sanitation District
State Coastal Conservancy
Zone 7 Water Agency

Table SFB-3 Sources of Imported Surface Water, San Francisco Bay Hydrologic Region

Water conveyance facility	Water source	Operator	Counties served	Water supplied to the Bay Region via facility in 2005
San Felipe Unit of CVP	Delta via San Luis Reservoir	USBR (CVP)	Santa Clara and San Benito Counties	35.6 TAF (4%)
Sonoma and Petaluma Aqueducts	Russian River	SCWA	Sonoma and Marin Counties	30.8 TAF (4%)
North Bay Aqueduct - SWP	Northern Delta	DWR (SWP)	Solano and Napa Counties	40.2 TAF (5%)
Putah South Canal	Lake Berryessa	USBR	Solano County	44.1 TAF (5%)
Contra Costa Canal	Western Delta	CCWD (CVP)	Contra Costa County	59.0 TAF (7%)
South Bay Aqueduct - SWP	Delta	DWR (SWP)	Alameda and Santa Clara Counties	131.8 TAF (16%)
Mokelumne Aqueduct	Mokelumne River	EBMUD	Alameda and Contra Costa Counties	200.6 TAF (25%)
Hetch Hetchy Aqueduct	Tuolumne River	SFPUC	San Francisco, San Mateo, Alameda, and Santa Clara Counties	267.3 TAF (33%)

Table SFB-4 Community Drinking Water Systems, San Francisco Bay Hydrologic Region

Community drinking water system	Number	Percent	Population served	Percent of population served
Large (> 10,000 people)	54	28	6,381,090	98.3
Medium (3,301 to 10,000 people)	7	4	48,619	0.7
Small (500 to 3,300 people)	27	14	49,051	0.8
Very Small (< 500 people)	96	51	12,484	0.2
Wholesale	6	3	-	-
Total	190	100	6,491,244	100
			6,976,224 in SB x7-7 sec	

Notes:

1. Sonoma County Water Agency's system is in both the North Coast and Bay Regions. It is counted only in the North Coast Region to avoid duplicative counting.

2. The City of Morgan Hill's system is in both the Central Coast and Bay Regions. It is counted only in the Central Coast Region to avoid duplicative counting.

Table SFB-5 San Francisco Bay Hydrologic Region Water Balance for 1998-2005 (thousand acre-feet)

San Francisco Bay	Water year (percent of normal precipitation)							
	1998 (188%)	1999 (109%)	2000 (109%)	2001 (81%)	2002 (98%)	2003 (89%)	2004 (98%)	2005 (129%)
Water entering the region								
Precipitation [a]	11,438	6,784	6,644	4,908	6,061	5,539	6,072	8,047
Inflow from Oregon/Mexico	0	0	0	0	0	0	0	0
Inflow from Colorado River	0	0	0	0	0	0	0	0
Imports from Other Regions	764	926	823	872	950	1,157	1,163	1,175
Total	12,202	7,710	7,467	5,780	7,011	6,696	7,235	9,222
Water leaving the region								
Consumptive use of applied water [b] (Ag, M&I, Wetlands)	363	545	394	415	472	431	452	395
Outflow to Oregon/Nevada/Mexico	0	0	0	0	0	0	0	0
Exports to other regions	0	0	0	0	0	0	0	0
Statutory required outflow to salt sink	23	1,353	22	20	787	651	739	1,444
Additional outflow to salt sink	664	589	727	759	674	701	518	569
Evaporation, evapotranspiration of native vegetation, groundwater subsurface outflows, natural and incidental runoff, ag effective precipitation & other outflows	11,146	5,408	6,234	4,795	5,028	4,804	5,405	6,636
Total	12,196	7,895	7,377	5,989	6,961	6,587	7,114	9,044
Storage changes in the region	76	-37	-25	-56	-37	40	-39	52
[+] Water added to storage								
[-] Water removed from storage								
Change in surface reservoir storage								

San Francisco Bay	Water year (percent of normal precipitation)							
	1998 (188%)	1999 (109%)	2000 (109%)	2001 (81%)	2002 (98%)	2003 (89%)	2004 (98%)	2005 (129%)
Water entering the region								
Change in groundwater storage [c]	-70	-148	115	-153	87	70	160	127
Total	6	-185	90	-209	50	110	121	179
Applied water [b] (compare with consumptive use)	1,060	1,192	1,158	1,214	1,285	1,254	1,237	1,180

[a] The percent precipitation is based upon a running 30 year average of precipitation for the region and discrepancies can occur between information calculated for Update 2009 and earlier published data.

[b] Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

[c] Change in groundwater storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River, and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage – withdrawals.

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table SFB-6 Flood Management Agencies, San Francisco Bay Hydrologic Region

	Structural approaches						Land use management								Preparedness, response, and recovery												
	Flood projects						Flood plains			Flood insurance			Regu-lation		Data manage-ment	Event management											
	Financing	Development	Construction	Operation	Encroachment	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated flood ways	Data collection	Hydrologic	Data station	Flood education	Preparedness	Response	Response	System	Recovery funding	Recovery	Mitigation
Federal agencies																											
Federal Emergency Management Agency										☐		☐											☐		☐
National Weather Service															☐	☐	☐	☐	☐	☐	☐				
Natural Resources Conservation Service	☐	☐	☐															☐							
U.S. Geological Survey															☐	☐	☐								
U.S. Army Corps of Engineers	☐	☐	☐	☐	☐	☐									☐	☐	☐	☐	☐	☐	☐		☐	☐	☐
State agencies																											
California Conservation Corps																				☐	☐				
Department of Corrections																					☐				
Department of Forestry and Fire Protection																				☐					
Department of Water Resources	☐	☐	☐	☐	☐	☐			☐	☐		☐			☐	☐	☐	☐	☐	☐	☐		☐	☐	
Office of Emergency Services																			☐	☐	☐	☐	☐		☐
Local agencies																											

	Structural approaches						Land use management								Preparedness, response, and recovery										
	Flood projects						Flood plains			Flood insurance			Regu-lation		Data manage-ment			Event management							
	Financing	Development	Construction	Operation	Encroachment	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated flood ways	Data collection	Hydrologic	Data station	Flood education	Preparedness	Response	Response	System	Recovery funding	Recovery	Mitigation
County and city emergency services units																			☐	☐	☐				
County and city planning departments														☐											
County and city building departments													☐												
Local conservation corps																				☐	☐				
Local initial responders to emergencies																			☐	☐	☐				
Alameda County FCWCD	☐	☐			☐	☐																			
Contra Costa County FCWCD	☐	☐			☐	☐									☐	☐	☐								
Marin County FCWCD	☐	☐			☐	☐									☐		☐								
Napa County FCWCD	☐	☐	☐	☐	☐	☐																			
San Francisco Department of Public Works																		☐	☐						
San Francisquito Creek Joint Powers Authority	☐	☐																							
San Mateo County Flood Control District	☐																								
Santa Clara Valley Water Agency	☐	☐	☐	☐	☐	☐	☐	☐			☐							☐	☐	☐	☐				

	Structural approaches						Land use management								Preparedness, response, and recovery									
	Flood projects						Flood plains			Flood insurance			Regu-lation		Data manage-ment	Event management								
	Financing	Development	Construction	Operation	Encroachment	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated flood ways	Data collection	Hydrologic	Data station	Flood education	Preparedness	Response	Response	System	Recovery funding	Recovery	Mitigation
Sonoma County Water Agency	□	□	□		□	□	□											□							
Zone 7 Water Agency	□	□	□		□	□	□											□							

Note: FCWCD=Flood Control and Water Conservation District

Table SFB-7 Record Floods, San Francisco Bay Hydrologic Region

Stream	Location	Mean annual runoff (taf)	Peak stage of record (ft)	Peak discharge of record (cfs)
Guadalupe River	above Highway 101, at San Jose	57	14.6	6,070
Coyote Creek	above Highway 237, at Milpitas	34	13.9 [a]	2,550
Coyote Creek	near Gilroy	35	13.8 [a]	10,100
Alameda Creek	near Niles	101 [b]	14.8	29,000
Arroyo de La Laguna	at Verona	55 [b]	22.6	11,400
Arroyo Valle	near Livermore	17 [b]	9.2	2,980
Napa River	near Napa	155 [b]	30.5 [a]	37,100
Napa River	near St. Helena	68	23.6	18,300
Sonoma Creek	at Agua Caliente	53	32.5	20,300

Note: taf=thousand acre-feet; ft=feet; cfs=cubic feet per second

[a] Different date than peak discharge

[b] Most recent but less than period of record

Table SFB-8 Flood Control Facilities, San Francisco Bay Hydrologic Region

Facility	Stream	Owner (sponsor)	Description	Protects
Reservoirs and lakes				
L. Chesbro	Llagas Cr.	Santa Clara Valley WD	3 taf flood control	San Jose
L. Del Valle	Arroyo Valle	DWR	38 taf flood control	Pleasanton, Fremont, Niles, Union City
Cull Cr.	Cull Cr.	Alameda Co. FCWCD (NRCS)	310 AF flood control	Castro Valley
Non-storage flood control facilities				
Alameda Cr.	Alameda Cr.	USACE	Channel Improvement	Livermore Valley, Niles Canyon, coastal plain
Emeryville Marina—Point Park	San Francisco Bay	USACE	Bank protection	Emeryville
Fairfield Streams	Ledgewood Cr., Laurel Cr., McCoy Cr., Pennsylvania Ave. Cr., Union Ave. Cr.	USACE	Channel enlargement, creek diversion	Fairfield and vicinity
San Lorenzo Cr.	San Lorenzo Cr.	USACE	Levees, concrete channel	San Lorenzo, Hayward
Walnut Cr.	Walnut Cr., San Ramon Cr., Grayson Cr., Pacheco Cr., Pine Cr., Galindo Cr.	USACE	Levees, channel stabilization, channel improvement	Walnut Creek, Concord, Pacheco, Vine Hill, Pleasant Hill
Corte Madera Cr.	Corte Madera Cr. and tributaries	USACE (Marin Co. FCWCD)	Channel improvement	San Anselmo, Ross, Kentfield, Larkspur, Corte Madera, Greenbrae, Fairfax
Novato Cr.	Novato Cr., Warner Cr., Avichi Cr.	Marin Co. FCWCD	Channel improvement	Novato
Coyote and Berryessa Crs.	Coyote Cr. (Santa Clara Co.), Berryessa Cr.	USACE (Santa Clara Valley WD)	Channel improvement	Alviso, Milpitas, San Jose
Guadalupe R.	Guadalupe R.	USACE (Santa Clara Valley WD)	Channel improvement, bypass tunnel	San Jose
San Francisquito Cr.	San Francisquito Cr.	San Francisquito Creek JPA	Levee restoration	East Palo Alto, Menlo Park
Napa R. Basin	Napa R., Napa Cr.	USACE (Napa Co. FCWCD)	Levees, floodwalls, bypass, channel improvements	Napa, St. Helena
Petaluma R.	Petaluma R.	Sonoma Co. WA	Floodwalls	Petaluma
Wildcat and San Pablo Crs.	Wildcat Cr., San Pablo Cr.	USACE (Contra Costa Co. FCWCD)	Levees, channel, channel improvements, sedimentation basins	San Pablo, Richmond
Coyote Cr.	Coyote Cr. (Marin Co.)	USACE	Lined and unlined channels	Tamalpais Valley

Facility	Stream	Owner (sponsor)	Description	Protects
Green Valley Cr.	Green Valley Cr., Dan Wilson Cr.	USACE	Realigned and enlarged channel	Agricultural and urbanizing lands north of Suisun Bay
Pinole Cr.	Pinole Cr.	USACE	Unlined channel	Pinole
Non-storage flood control facilities				
Rheem Cr.	Rheem Cr.	USACE	Lined and unlined channels	San Pablo
Rodeo Cr.	Rodeo Cr.	USACE	Lined and unlined channels	Rodeo
San Leandro Cr.	San Leandro Cr.	USACE	Lined and unlined channels	Oakland, San Leandro
Lower Pine Cr.	Pine Creek	Contra Costa FCWCD (NRCS)	Detention basin	Concord
Napa R.	Napa R.	Napa Co. FCWCD (NRCS)	Contributions to Napa R. Basin Project	Napa, St. Helena
Lower Silver Cr.	Silver Cr.	Santa Clara Valley WD (NRCS)	Channel improvement	San Jose

Note: taf=thousand acre-feet

Table SFB-9 Flood Emergency Responders, San Francisco Bay Hydrologic Region

Responder	Level	Comment
Person(s) or organization(s) on the site	0	Any emergency
Emergency services units of the 86 cities in the region	1	Any emergency
Emergency services units of the 9 counties in the region	1 or 2	Any emergency, and by request from Level 1 responders
Department of Water Resources	2	Flood Operations Center, flood fight, and Corps liaison
California Emergency Management Agency, Coastal Region	3	Any emergency, entire hydrologic region by request of the county (operational area)
U. S. Army Corps of Engineers	3	Specified water-related emergencies at request of DWR
California Conservation Corps	3	Personnel and equipment for flood fight
Department of Forestry and Fire Protection	3	Personnel and equipment for flood fight
California Emergency Management Agency Headquarters	4	All emergencies, entire hydrologic region, by request of Cal EMA Region

Table SFB-10 Applicability of Resource Management Strategies, San Francisco Bay Hydrologic Region

Strategy	Applicability	Potential Benefits
Reduce Water Demand		
Agricultural water use efficiency		Water supply, drought preparedness, water quality, operational flexibility and efficiency, environmental, reduced groundwater overdraft
Urban water use efficiency		Water supply, drought preparedness, water quality, operational flexibility and efficiency, environmental, energy, reduced groundwater overdraft
Improve Operational Efficiency and Transfers		
Delta conveyance		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, recreational opportunities, reduced groundwater overdraft
Regional/local conveyance		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, recreational opportunities, reduced groundwater overdraft
System reoperation		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, reduced groundwater overdraft
Water transfers		Water supply, drought preparedness, operational flexibility and efficiency, environmental
Increase Water Supply		
Conjunctive management and groundwater		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, reduced groundwater overdraft
Desalination		Water supply, drought preparedness, water quality, operational flexibility and efficiency, environmental, reduced groundwater overdraft
Precipitation enhancement		Water supply, energy
Recycled municipal water		Water supply, drought preparedness, water quality, operational flexibility and efficiency, environmental, energy, reduced groundwater overdraft
CALFED Surface storage		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, recreational opportunities
Regional/local surface storage		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, recreational opportunities
Improve Water Quality		
Drinking water treatment and distribution		Water supply, water quality, operational flexibility and efficiency
Groundwater and aquifer remediation		Water supply, water quality
Matching water quality to use		Water supply, water quality, operational flexibility and efficiency, environmental

Strategy	Applicability	Potential Benefits
Pollution prevention		Water supply, water quality, reduced flood impacts, environmental, energy, recreational opportunities, reduced groundwater overdraft
Salt and salinity management		Water supply, water quality, operational flexibility and efficiency, environmental, energy
Increase Water Supply		
Urban runoff management		Water supply, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, recreational opportunities, reduced groundwater overdraft
Practice Resource Stewardship Agricultural lands stewardship		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, recreational opportunities, reduced groundwater overdraft
Economic incentives		Water supply, drought preparedness, water quality, operational flexibility and efficiency, environmental, reduced groundwater overdraft
Ecosystem restoration		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, reduced groundwater overdraft
Forest management		Water supply, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy
Land use planning and management		Water supply, drought preparedness, water quality, reduced flood impacts, environmental, energy, recreational opportunities
Recharge area protection		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, reduced groundwater overdraft
Water-dependent recreation		reduced flood impacts, environmental, recreational opportunities
Watershed management		Water supply, drought preparedness, water quality, operational flexibility and efficiency, reduced flood impacts, environmental, energy, recreational opportunities, reduced groundwater overdraft
Improve Flood Management		
Flood risk management		Water supply, drought preparedness, water quality, reduced flood impacts, environmental, energy, reduced groundwater overdraft

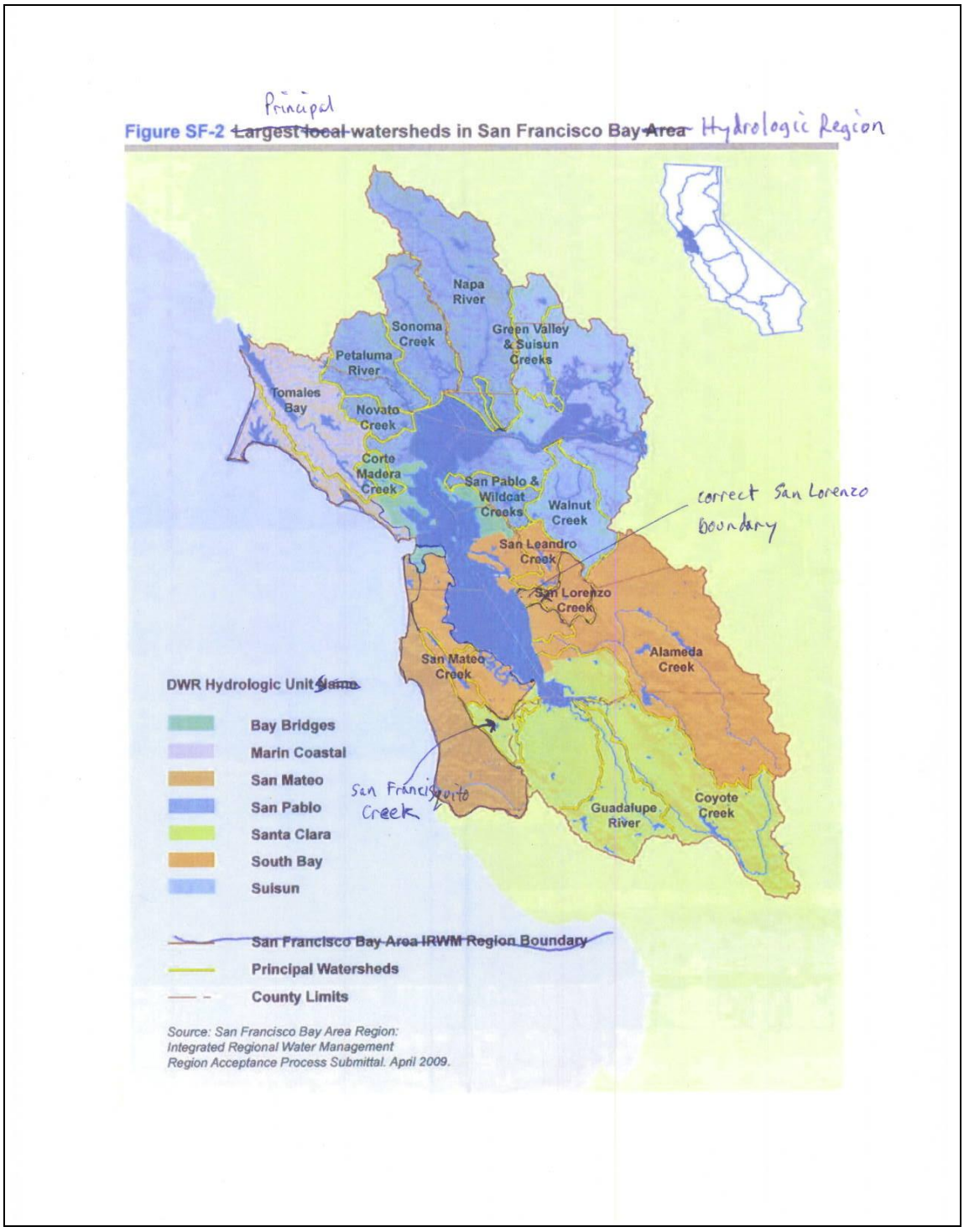
Other strategies: Crop idling for water transfers, dewvaporation or atmospheric pressure desalination, fog collection, irrigated land retirement, rain-fed agriculture, water-bag transport/storage technology

New strategies: Outreach and education, sediment management, water-dependent cultural practices

Figure SFB-1 Map of the San Francisco Bay Hydrologic Region

[This graphic will be updated.]

Figure SFB-2 Principal Watersheds in the San Francisco Bay Hydrologic Region



[This graphic will be updated.]

Figure SFB-3 Groundwater Basins in the San Francisco Bay Hydrologic Region

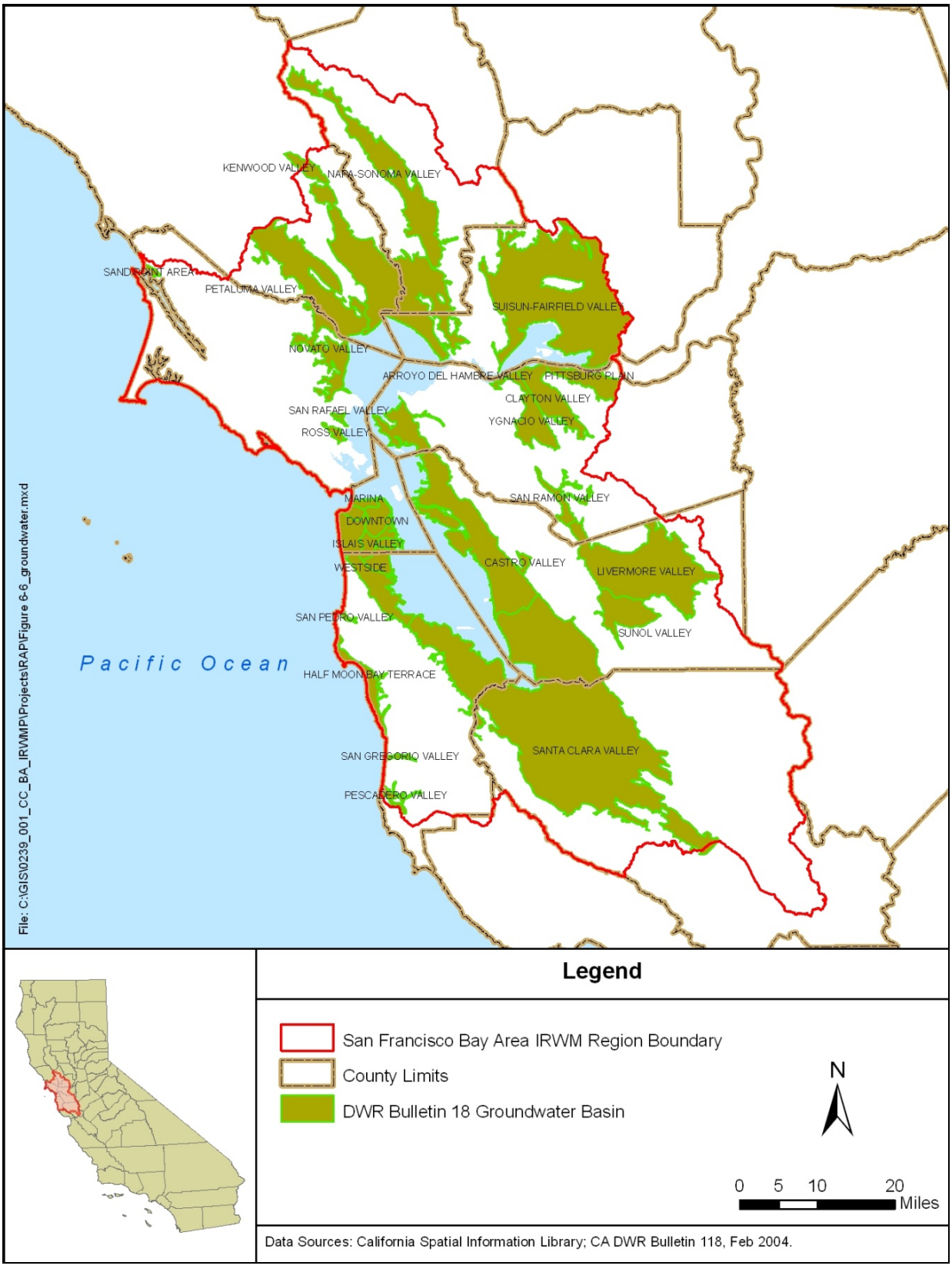
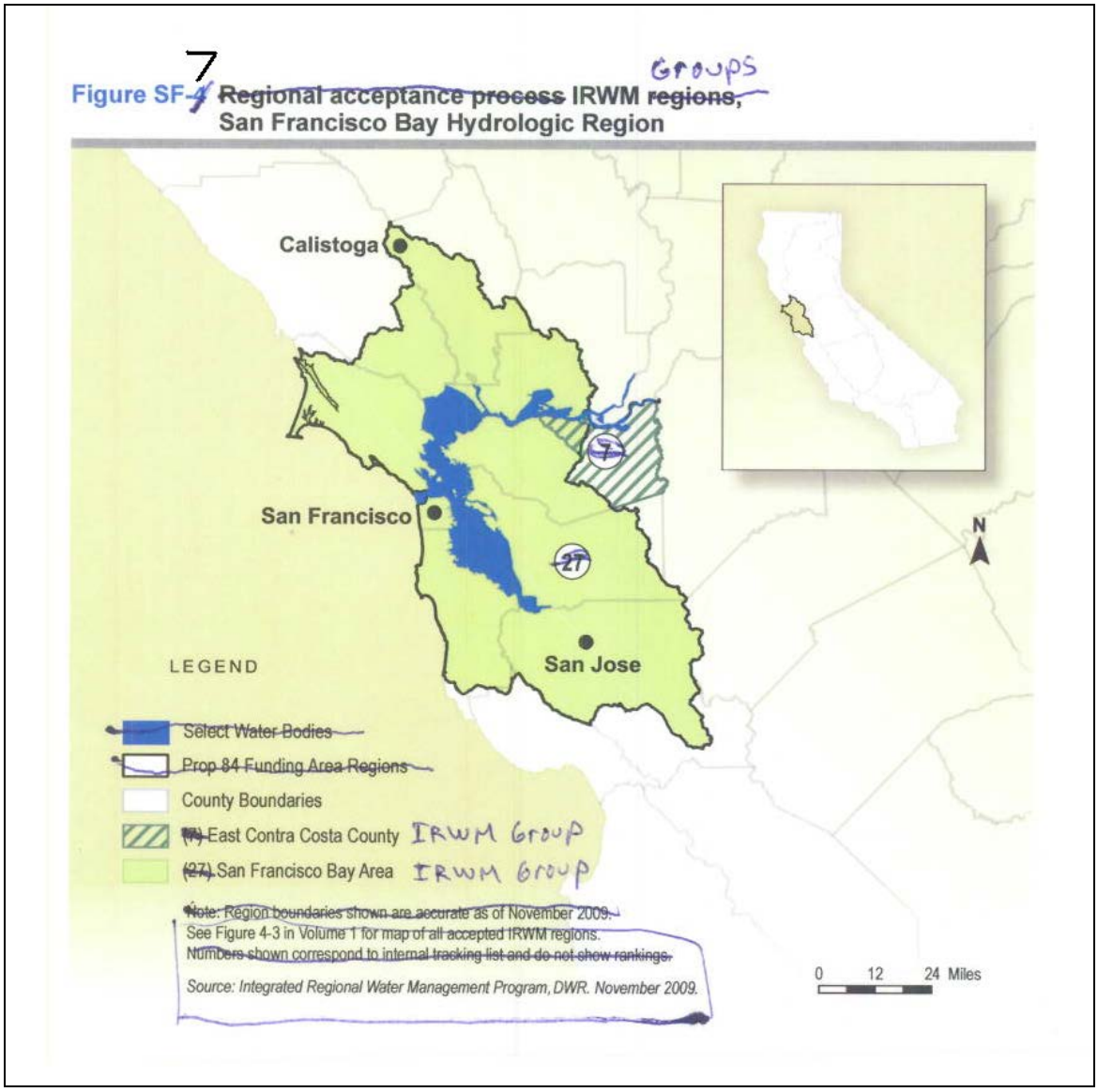
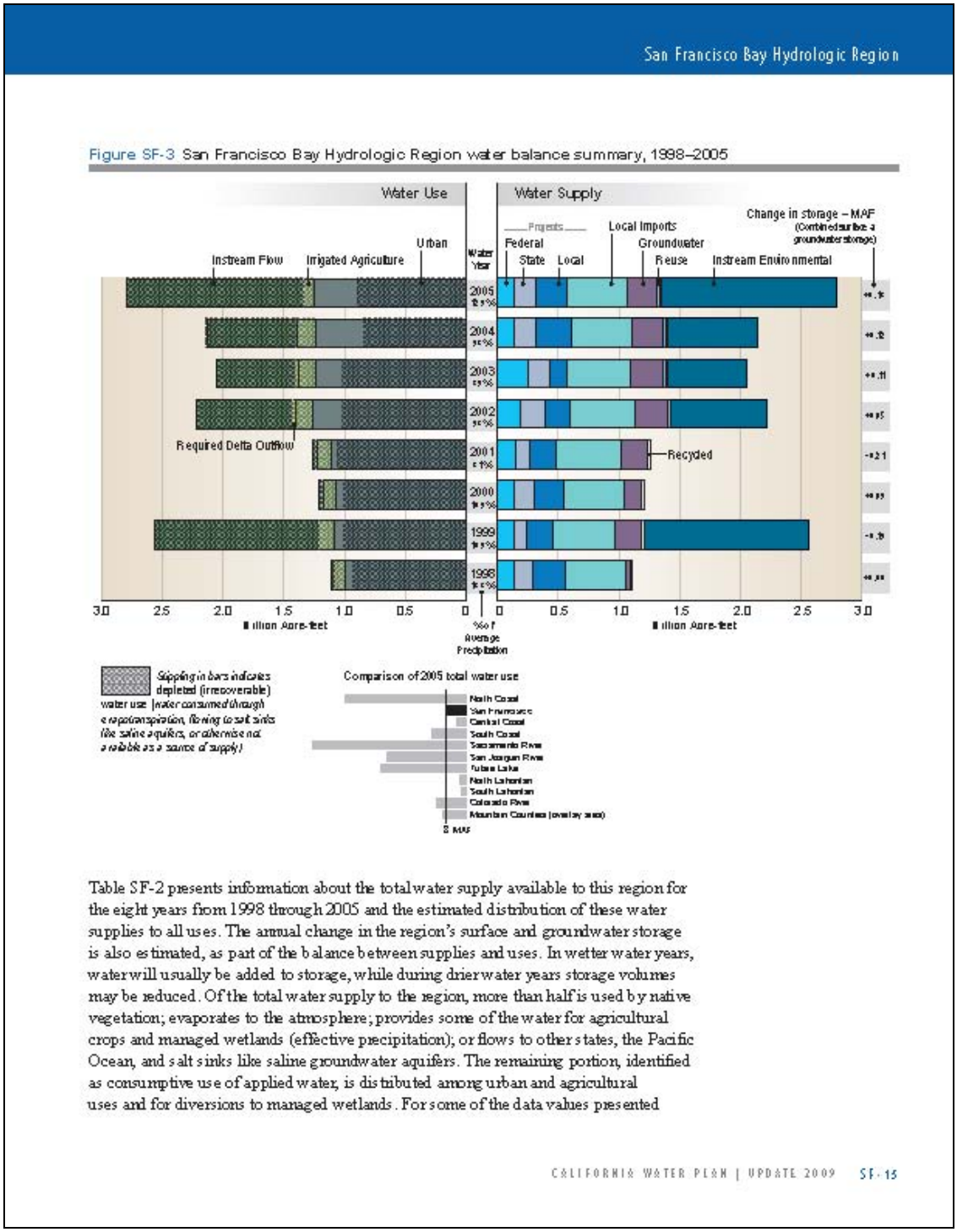


Figure SFB-4 Integrated Regional Water Management Groups in the San Francisco Bay Hydrologic Region



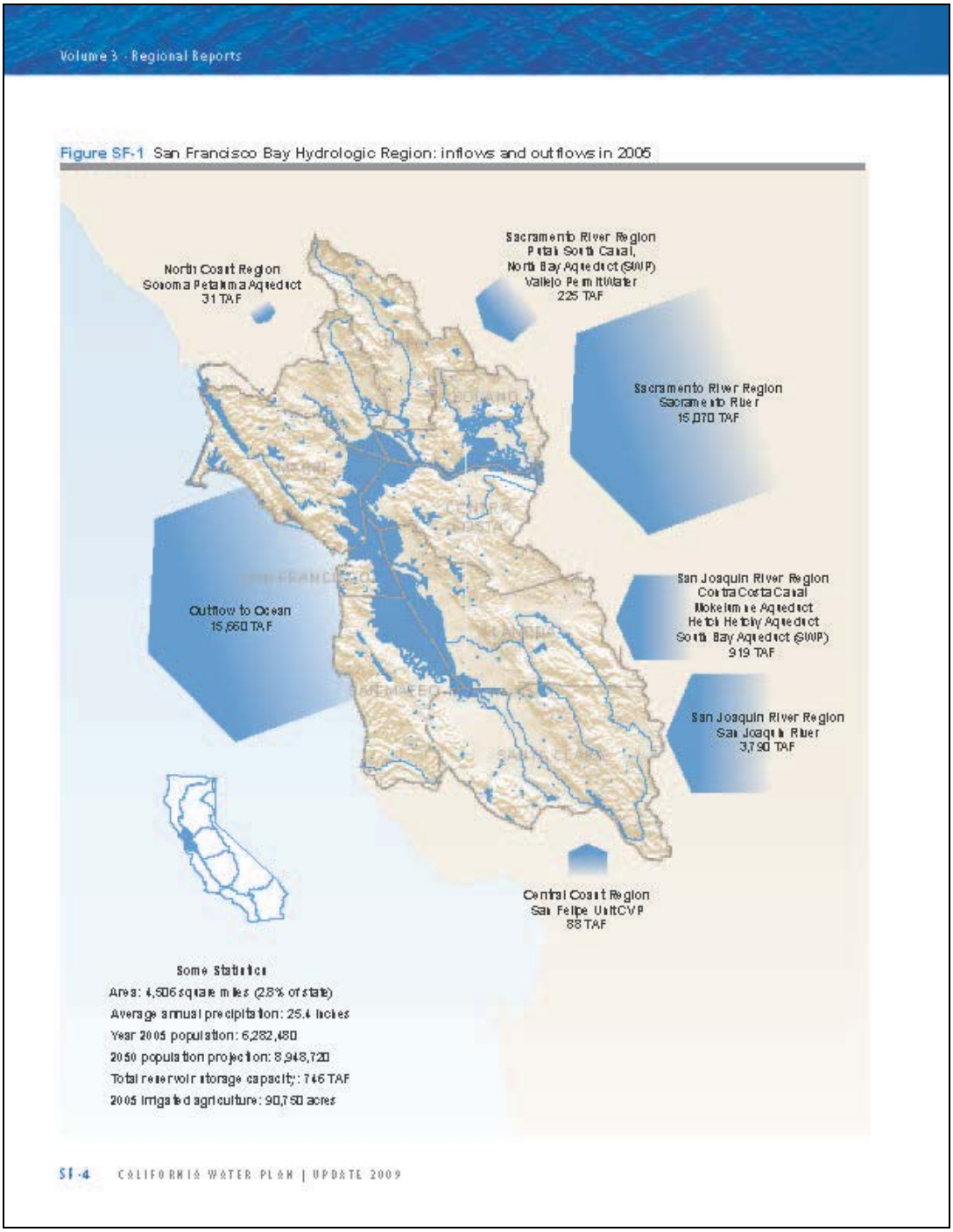
[This graphic will be updated.]

Figure SFB-5 San Francisco Bay Hydrologic Region Water Balance



[This graphic will be updated.]

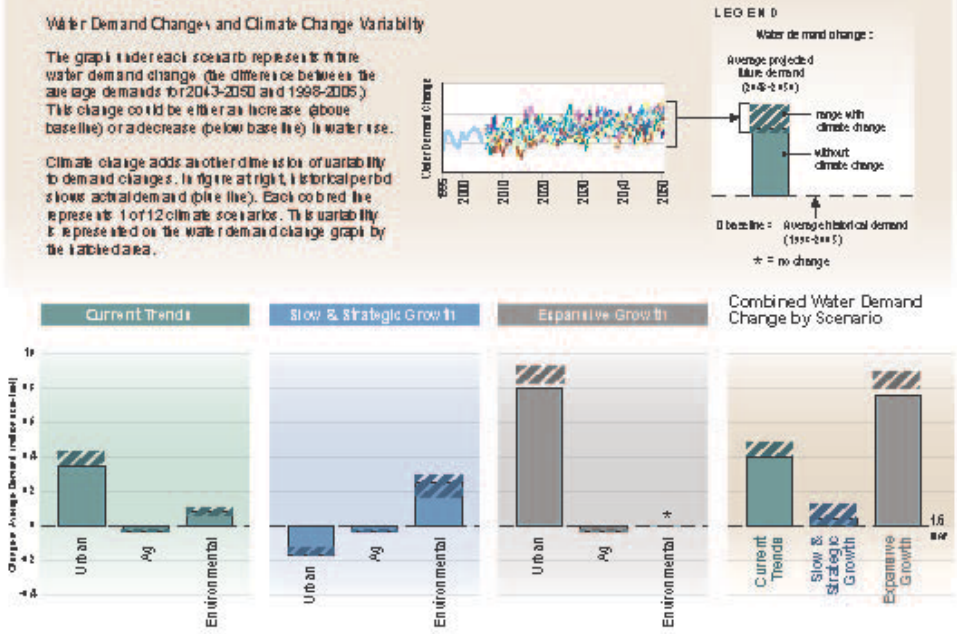
Figure SFB-6 Water Imports to the San Francisco Bay Hydrologic Region



[This graphic will be updated.]

Figure SFB-7 Water Demand Changes in the San Francisco Bay Hydrologic Region

Figure SF-5 2050 Water demand changes, San Francisco Bay Hydrologic Region



Growth scenarios. Without climate change, Current Trends and Expansive Growth both show an increase in water demand of 350 thousand acre-feet and 800 thousand acre-feet, respectively. But, Slow & Strategic Growth shows a reduction in water demand of about 165 thousand acre-feet when compared with historical average. When climate change is considered, the change in water demand is even more pronounced under Expansive Growth. The range varies from a minimum of 830 thousand acre-feet to a maximum of 925 thousand acre-feet for the 12 climate sequences studied. Under the Slow & Strategic Growth scenario, a smaller reduction in water demand is observed when climate change was factored in, which ranged in a reduction between 130 thousand acre-feet and 165 thousand acre-feet.

Agricultural Demand Change

Change in agricultural water demand in the Bay Region is shown in Figure SF-5. Agricultural water demand is generally reduced due to reduction in irrigated acreage and increases in background water conservation. Without climate change (solid bar), all three scenarios show almost the same reduction in water demand of about

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[This graphic will be updated.]

Figure SFB-8 Energy Intensity of Raw Water Extraction and Conveyance in the San Francisco Bay Hydrologic Region

Box SFB-1 Planning Organizations, San Francisco Bay Hydrologic Region

Bay Area/North Coast/Central Coast Water Quality and Sustainability Work Group. This workgroup was formed to identify and describe the connections between water quality and climate change on the coast from central California to the Oregon border, as well as recommend actions in the water quality arena that can help reduce greenhouse gases or help solve climate change problems.

Bay Area Water Supply and Conservation Agency (BAWSCA). BAWSCA represents the interests of 26 cities and water districts, and two private utilities that purchase wholesale water from the San Francisco Public Utilities Commission (SFPUC) regional water system. BAWSCA's goals are to ensure high quality, reliable water supply for the 1.7 million people residing in Alameda, Santa Clara, and San Mateo Counties who depend on the SFPUC regional water system. (Website: www.bawsca.org)

Bay Area Water Forum. The forum first convened in 2000 to provide a venue for all stakeholders in the Bay Region, including water, wastewater, flood control, and storm water agencies; local governments; environmental and business groups; community and civic organizations; and the general public. The forum educates and works cooperatively with others on key regional water resources issues. (Website: www.baywaterforum.org)

Association of Bay Area Governments (ABAG). Formed in 1961, ABAG is the official comprehensive planning agency for the Bay Region. ABAG's mission is to strengthen cooperation and coordination among local governments to address social, environmental, and economic issues that transcend local borders. (Website: www.ABAG.ca.gov)

Bay Area Water Agencies Coalition. The coalition was established in 2002 to provide a forum and a framework for water agency general managers to discuss water management planning issues and coordinate projects and programs to improve water supply reliability and water quality.

Northern California Salinity Coalition. This coalition of eight water agencies was created in 2003 to advance local and regional efforts to use desalination or salinity management technologies that reduce salinity problems and improve water supply reliability for member agencies.

Bay Area Clean Water Agencies (BACWA). Founded in 1984, BACWA is an association comprised of local governmental agencies that own and operate treatment works that discharge into the San Francisco Bay Estuary. BACWA's members serve more than 6 million people in the Bay Area, treating all domestic and commercial wastewater and a significant volume of industrial wastewater. (Website: www.bacwa.org)

Bay Planning Coalition (BPC). Established in 1983, the BPC is a nonprofit, membership-based organization representing the maritime industry and related shoreline business, ports and local governments, landowners, recreational users, environmental and business organizations, and professional service firms in engineering, construction, law, planning, and environmental sciences. (Website: www.bayplanningcoalition.org)

Bay Area Flood Protection Agencies Association (BAFPAA). Established in 2006 as an outgrowth of the Bay Area IRWM process, membership in BAFPAA includes Bay Area counties and special districts with responsibility for flood protection and storm water management.

Bay Area Integrated Regional Water Management Coordinating Committee. Forming the committee was a significant accomplishment in regional water resources planning. It outlines the region's water resources management needs and objectives, and presents innovative strategies and a detailed implementation plan to achieve the objectives. (Website: www.bairwmp.org)

Bay Area Watershed Network. The network was organized in 2006 to bring together a wide variety of agencies, technical experts, and nongovernmental organizations (NGOs) with diverse expertise to work on proposals and activities involving watershed management, planning, and restoration. Smaller teams work on policy, coordination with the IRWM process, assessment and monitoring tools, and education and outreach activities. (Meeting information at www.sfbayjv.org)

Box SFB-2 Scenario Descriptions

Update 2009 has three future scenarios through the year 2050 to which the water community would need to respond regionally by implementing a mix of resource management strategies. The scenarios are referred to as baseline because they represent changes that are plausible and could occur without additional management intervention beyond those currently planned. Each scenario affects water demands and supplies differently.

Scenario 1 – Current Trends. For this scenario, recent trends are assumed to continue into the future. In 2050, nearly 60 million people live in California. Affordable housing has drawn families to the interior valleys. Commuters take longer trips in distance and time. In some areas where urban development and natural resources restoration has increased, irrigated cropland has decreased. The state continues to face lawsuits: from flood damages to water quality and endangered species protections. Regulations are not comprehensive or coordinated, creating uncertainty for local planners and water managers.

Scenario 2 – Slow & Strategic Growth. Private, public, and governmental institutions form alliances to provide for more efficient planning and development that is less resources intensive than current conditions. Population growth is slower than currently projected—about 45 million people live here. Compact urban development has eased commuter travel. Californians embrace water and energy conservation. Conversion of agricultural land to urban development has slowed and occurs mostly for environmental restoration and flood protection. State government implements comprehensive and coordinated regulatory programs to improve water quality, protect fish and wildlife, and protect communities from flooding.

Scenario 3 – Expansive Growth. Future conditions are more resource intensive than existing conditions. Population growth is faster than currently projected with 70 million people living in California in 2050. Families prefer low-density housing, and many seek rural residential properties, expanding urban areas. Some water and energy conservation programs are offered but at a slower rate than trends in the early century. Irrigated cropland has decreased significantly, where urban development and natural restoration have increased. Protection of water quality and endangered species is driven mostly by lawsuits, creating uncertainty.